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NIAGARA AS AN INDUSTRIAL CENTER.—[See page 343.]

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NEW YORK, SATURDAY, MAY 27, 1899.

IS SMOKELESS POWDER RELIABLE?

It will be a great misfortune if the recent bursting of a 10-inch gun at Sandy Hook disturb the confidence of our artillerists in the reliability of smokeless powder just at the time when we are introducing it extensively into our naval and military service. For the idea of abolishing the new powder is not to be entertained for a moment—all Europe is committed to its use, and we are already so far behind in this matter that a retrograde step at this juncture would be disastrous. We have been informed on the very best authority that immediately upon receipt of the tidings of the Sandy Hook disaster, the department canceled all orders for smokeless powder. If this be the case, the responsible authorities must have been in a state bordering upon panic, and the War Department, surely, is the last quarter in which a panic should be possible.

The accident is being made the subject of an exhaustive inquiry whose resulting verdict would carry more weight if the question of smokeless powder had been taken up in earnest half a dozen years earlier than it was, and our ordnance officers had acquired that familiarity with the subject which can only be gained by long and careful study in the laboratory and at the proving ground. It is an open secret that the War Department has been prejudiced, or, shall we say, ultra-conservative, in its attitude toward this supreme military question; and in its investigation of this, the first actual catastrophe due to the new propellant, it should guard against jumping to hasty conclusions, or being influenced by preconceived ideas. Conservatism is an excellent quality in the abstract, and there are certain spheres of activity in which we cannot well have too much of it. But the field of artillery and explosives is certainly not one of these; and it is a question whether it was not the determination of our experts to take no risks and make no mistakes that placed the country in the serious plight as to powder in which it was found at the opening of the Spanish war.

Official conservatism—the determination not to imperil expert reputation by risky but none the less imperative experimental work—is responsible for many of the fatalities at Santiago and in the Philippines. Surely, in our experimental work we could have afforded to burst an occasional gun or wreck a powder factory, if by such work the 20 or 30 per cent increase in our dead and wounded due to telltale brown powder would have been avoided. And that it could have been avoided the official dispatches only too clearly show.

We feel that it is impossible to attach too much importance to the smokeless powder discussion—seeing that it touches so nearly the very foundation of our system of naval and military defenses—and hence, we have thrown open our columns more freely than is our custom to the ventilation of a special technical question. In the current issue of the SUPPLEMENT will be found an article from Mr. McGahie, who has been intimately associated with the production of the form of smokeless powder adopted by the army and navy, on the question of Wave Action in Guns. Some of the data presented will be in the nature of a surprise to anyone who believes that the era of dangerous pressures was ushered in with the advent of smokeless powders and that the era of safety died with the passing of the "brown prismatic." The firing records obtained under the late Capt. Sidney E. Stuart prove that it was possible for practically the same charges of brown powder to show a variation of over 80 per cent in the pressures developed. Thus while 400 pounds in a 12-inch gun gave a normal chamber pressure of 36,000, 406 pounds showed a pressure of 60,000 pounds; while of two charges of 200 pounds in a 10-inch gun, one showed 37,600 pounds in the chamber and the other 59,000 pounds. Mr. Brown, the inventor of the wire gun of that name, is jubilant over the fact that in the 157th round at the test of his first 5-inch gun, a pressure of 82,600 pounds was recorded in the gages—a result which was as damning to the brown powder as it was creditable to the gun.

Evidently occasional irregularity in pressures is not confined to powders of the smokeless kind, and in view of the general excellence and uniformity of the results obtained with our smokeless powder, we cannot but feel that any determination to stop the introduction of an up-to-date propellant into our service is greatly to be deplored. As is shown in the article referred to, the possible causes of abnormal pressure have been investigated and are in a fair way to become definitely known. Here, by the way, is one of the most promising and alluring fields for further investigation of which we know.

THE FORTY-FOOT ENTRANCE TO NEW YORK HARBOR.

It is a cause of genuine gratification that the contract has now been let for dredging the great forty-foot entrance channel to New York Harbor. The position of New York as the leading port in the New World, and the point of arrival and departure of the great trans-Atlantic steamship companies, renders it imperative that its facilities shall not only be equal to the growing demands of shipping, but that they shall anticipate them. It goes without saying that, for a harbor to be entitled to rank as first-class, it must be capable of receiving the largest vessels at any state of the tide, and New York has always seen to it that the entrance channels to its harbor were deepened from time to time to meet the increasing draught of the largest ocean steamers. In 1881, when the maximum draught was 22 feet, the main channel was maintained at 24 feet; in 1891, when the draught had increased to between 25 and 27 feet, the channel was deepened to 30 feet; and last year, when the maximum draft of vessels actually entering the harbor had risen to 32 feet, and other even larger ships were either building or planned, it was decided by Congress to dredge out an entirely new channel, and increase the depth to 40 feet. At first sight this looks like an extravagant depth, especially as it is to be maintained for a clear width of 2,000 feet; but he is a bold man who, in view of the rapidity with which the dimensions of ocean steamships are increasing, will venture to predict that it will prove to be in excess of the requirements of the near future.

The present main ship channel is crooked and somewhat difficult to navigate, containing one sharp turn of about 95.° The new channel, which is to be about 7 miles in length, will commence on a southerly course and at once curve with a broad, easy sweep to a southeasterly course, on which it will run in a direct line to the 40-foot contour, 5 miles outside of Sandy Hook. The present soundings on the line of the channel vary from 32 feet at the inner end to 16½ feet on the outer shoal, and the estimated quantity of sand to be removed is 40,000,000 cubic yards. The contract has been let to Mr. Andrew Onderdonk of this city at a rate of 9 cents per cubic yard. By the terms of the contract he is given a year in which to prepare his plant, and after that he must remove 400,000 cubic yards in each working month of the first year and 1,200,000 cubic yards in each working month of the succeeding years until the task is completed. The work should be finished in about six years.

The scheme also provides for an inside channel, which will extend from the Narrows to beyond the Erie Basin and follow the shoreline on the Brooklyn side. It will be 1,200 feet wide and 40 feet in depth. The dredging of this channel will involve the removal of between 20,000,000 and 30,000,000 cubic yards of material, and the contract price is $2,485,000, thus making the total cost of the improvements $6,085,000.

The outer channel will probably be excavated by powerful sea-going suction dredges, similar to those in use on the Mersey bar off Liverpool, an illustrated description of which appeared in the SCIENTIFIC AMERICAN of August 27, 1898. These vessels can pump up 2,000 cubic yards of sand from a depth of 50 feet in three-quarters of an hour. Their hopper capacity is 3,000 tons. It is likely that the inner channel will be excavated by dredges of this kind assisted by scoop dredges of the standard type.

A QUESTION OF GOVERNMENTAL ECONOMICS.

In these days of increasing paternalism, with a multitude of State and National Experiment Stations around us, we hear much of Economic Entomology, Economic Botany, etc., and rightly so. But there is a phase of the "economic" portion of this work which appears to be in grave danger of escaping from the public view under the weight of printed material now showered from these centers of research. The case of the introduced "Cabbage butterfly," *Pieris rapæ*, an insect now pretty generally distributed throughout the country, although known to science west of the Mississippi but a few years, is in point. An examination of the bibliography of this species of insect pest divulges the fact that there has been much over a hundred papers or tracts published having reference, solely or in great part, to this species; and a cursory examination of these is all that is necessary to prove that, in most of them, there are no new or pertinent facts recorded, and that they contain but a reprint or rehash of former work, usually that so well done under the auspices of the late United States Entomologist, Prof. C. V. Riley, or his able successor, Dr. L. O. Howard. The case of this butterfly is but one of many like cases; that of the Texas "horn-fly" is almost as marked. It would seem that, if this work is to continue to deserve the title "economic," the directors in charge of the Experiment Stations should devise some means whereby the original work of one station would be electrotyped, or even printed at some common headquarters, and from there distributed to all needing it. That each station best knows its individual needs, and is best able to distribute literature to its immediate constituency, there can be no doubt; but that the recompilation and typographic and illustrative reproduction that is now the rule is not based on true economy is equally beyond doubt. The appropriations at hand, and the time of the able corps of students conducting this work, are far too limited to warrant this form of wastefulness, while so many economic problems of the first magnitude remain practically untouched.

HOW OUR ART MANUFACTURES MAY AFFECT OUR EXPORTS.

Art and art industries receive much more encouragement abroad than in the United States. We do not fully realize in this country the commercial value of art as applied to industries. We have, of course, many firms who produce artistic iron and bronze work, silver, glass, and ceramics which compare favorably with almost anything produced in Europe; but there are many things of every-day use which are made in the United States for home consumption and for export which are far from beautiful, and their ugliness is wholly unnecessary, and in time this will have an influence upon the export of these articles. There are many articles which we make which are far better than those made in Europe, but they must be improved in other ways outside of the essentials of technical excellence and cheapness, if they are to hold their own against similar objects made in Europe.

The Hon. Charles DeKay, late Consul-General at Berlin, has devoted great attention to this subject, and has considered it in all its phases. If the manufacturers in the United States realized what efforts are being made in Europe by the foundation of industrial museums—museums and schools for textiles, wood carving, and cabinet making—they would soon perceive that so soon as the manufacturers of Europe obtain the machines with which we make our goods, they will produce these articles as cheaply, if not more cheaply, than we can do, owing to the lower wages which obtain there, and will add to that cheapness the beauty which the training in art of those who have a natural aptitude for it can give the articles. Mr. DeKay is not an alarmist, but his observations and the testimony of the industrial art periodicals of the world should teach us that we cannot be too quick to forestall the loss of such prestige as American manufactures already possess and prepare for a much closer rivalry in such objects in the near future. Those who visit the great exposition at Paris next year will see for themselves that his note of warning is justified.

THE MECHANICAL ENGINEERS AND THE PATENT OFFICE.

At the recent meeting of the American Society of Mechanical Engineers at Washington, a subject of great importance was brought up and discussed; this was the question of the inadequate facilities of the Patent Office, and it resulted in the adoption of resolutions urging Congress to provide more ample facilities for the conduct of the business of the Patent Office.

Resolved, That the association, as a body and through its individual members, urge upon Congress the necessity of relieving the present overcrowded condition of the Patent Office and providing sufficient room, force, and facilities for the prompt and proper execution of its work.

Resolved, That we further urge that the records of the office, which so largely constitute the legal evidence of title of so many of the large manufacturing industries of this country, should be more safely stored, and that ample appropriations be made for providing incombustible receptacles for the records.

Resolved, That we especially urge that the library of the Patent Office, upon which the efficiency and accuracy of the work of the bureau depend, shall have such ample appropriation for its extension in its special field and for keeping it fully abreast of the progress in the mechanical and manufacturing arts of the day.

Resolved, That this association urge the necessity of giving to the Patent Office the use of the entire building in which it is now located, and that the moneys paid into the Patent Office by inventors be applied so far as necessary to the uses of the office.

We are much gratified to see that this most important matter has been made the subject of resolutions by the distinguished and representative body of men that make up this society. Coming from every section of the country and representing practically every branch of the industrial arts, the members are well qualified to advocate the claims of an institution which has been the most potent influence in fostering and building up the great industrial interests of this country. These resolutions come as a timely indorsement of the efforts of Commissioner Duell and his immediate predecessors to secure, not special favors, but common justice and courtesy at the hands of Congress.

The disabilities under which the Patent Office labors

are so well known to our readers, and have been so persistently presented in the Commissioners' reports, and reiterated in the SCIENTIFIC AMERICAN, as to be thoroughly familiar to our readers. The most crying evils are that the work has to be done in cramped and altogether inadequate quarters, and that the records have long ago overtaken the accommodation for properly filing them. As the Commissioner says, "Many of the records are almost inaccessible, and by reason of lack of sufficient space, so arranged that it requires double the time it ought to find them. A fire-proof safe should be built in which to store those records that cannot be replaced. The legal title to millions of dollars of property would be jeopardized by the destruction of our assignment records."

The justice of the claims of the Patent Office to more consideration is rendered even more evident when it is borne in mind that the office is not a tax on the public, but actually has a sum of over $4,000 000 to its credit in the Treasury.

WIRELESS TELEGRAPHY.

General Greely, Chief of the Signal Corps, has made public the result of recent experiments with wireless telegraphy which have been tried by the Signal Corps of the United States Army. He states that since the announcement of the tests in space telegraphy by Signor Marconi, some two years ago, the subject has been under consideration, and recently experiments have been begun with the object of thoroughly testing the value of this means of communication for military and other governmental purposes. Special forms of apparatus have been designed and constructed for these tests and they have already shown sufficient promise to warrant further and systematic trials.

In the experiments thus far carried on, several forms of transmitters for the generation of the Hertzian waves have been used, and much promise has been realized from the use of a large alternating current coil as a generator instead of the ordinary Ruhmkorff coil employed by Marconi. This coil is energized by a three-quarters horse power rotary transformer furnishing an alternating current at 125 volts, and this arrangement makes a very powerful and efficient source of Hertzian radiation. The former receiver used has been substantially the Brankey "coherer," discovered in 1891, and the signals transmitted are recorded upon a receiving tape. The transmitter has been mounted upon the western elevation of the State, War and Navy building, utilizing the present wooden flagpole as the vertical wire for the transmitter. The receiver was first placed at the old Naval Observatory grounds, about three-quarters of a mile distant, and later moved to the Signal Corps station at Fort Myer, Va. During the experiments constant communication was kept up by heliograph and flags between the transmitting and receiving stations, and this greatly facilitated the work of experimenting. Signals, letters, and words have been transmitted and received between these stations, but the great delicacy required in the present receiver has made the transmission of regular messages as yet unreliable and uncertain. The presence of large buildings and masses of iron and metal, necessarily present in cities, make such places undesirable for carrying out experiments of this character.

The distance over which signals may be transmitted by a given apparatus is governed by the height of the vertical wire used at either end, and this has naturally suggested the use of small balloons such as have already been used for signal and other purposes by the Signal Corps. A supply of these balloons has already been obtained, and will be used for this purpose in the near future. General Greely considers that the value of wireless telegraphy for communication between light houses and lightships and the shore is very great, especially where cables cannot be permanently maintained. For the signaling between ships at sea, and to replace ordinary flag methods in use between naval vessels, it should prove invaluable, since no kind of weather, fog, darkness, nor storm will affect its use, but that it will supplant to a material extent the use of wire for ordinary commercial telegraphy is not believed. The use of metal reflectors to augment and direct the radiation to particular points has already met with partial success, and should be thoroughly investigated. At present the radiation proceeds from the transmitter in all directions, and the same message can be received at any point within a proper radius at which a receiver is placed. A satisfactory reflector and a receiver of the proper electric capacity, or in other words tuned to the vibration of the particular transmitter, will make a great advance in space telegraphy. While secrecy of transmission is among the probabilities, the present stage of experiment does not justify its positive prediction.

Members of the Lighthouse Board stationed at Tompkinsville, Staten Island, N. Y., will in a few days begin a series of experiments intended to test the value of wireless telegraphy for use in lighthouses and lightships. One set of instruments will be set up in a station near St. George, and efforts will be made to communicate with the Scotland lightship. Other experiments will include the Sandy Hook and Fire Island lightships. If the experiments are encouraging, they will endeavor to communicate with the Highland lights. The instruments will be isolated as far as possible from other electrical apparatus and it is not believed that there will be anything in the intervening space between the instruments which will interfere with the signaling. The instruments used will be of the Clarke type, which we have already illustrated.

THE BICYCLE INDUSTRY.

The opening of the wheeling season gives special interest to some figures just prepared by the Treasury Bureau of Statistics. These tables, which present the statistics of bicycle exports during the past few years, show that American wheels are now being ridden in all parts of the world. In the wilds of Mexico and Central America; under the blazing skies of Cuba, Porto Rico, and other West Indian islands; across the pampas of Argentine, Brazil, and other South American states; amid the densely populated areas of China, British East Indies, and Japan; and in the jungles of Africa, the American wheel is making its way. Even in the great manufacturing countries of Europe, where workshops and skilled workmen abound, millions of dollars' worth of American bicycles are sold each year. During the four fiscal years 1896, 1897, 1898, and 1899, the exportations of American bicycles amount in round numbers to $20,000,000.

That such large numbers of a machine requiring such high grades of workmanship in its production should be continuously and successfully exported in competition with the workshops of the most successful manufacturing countries of the world is a fact of which American workmen and Americans generally may justly feel proud. Four million dollars' worth of American bicycles will, during the fiscal year about to end, go to European countries—countries in which the manufacturing industries antedate by generations those of the United States. To France, with all her skilled workmen and ingenuity, exportations of American bicycles in the fiscal year 1899 will be more than double in value those of 1897; while the fact there has been a general lowering of prices indicates that in numbers the increase has been very much greater. To Germany the exportations of bicycles in 1899 will be 60 per cent in excess of those of 1897, though something less than those of 1898. To other countries on the Continent of Europe the bicycle exports of 1899 are 50 per cent in excess of those of last year or the year before. To the United Kingdom the bicycle exports of the year are materially less than those of 1898 as measured by values, though the fall in prices probably accounts for much of the apparent reduction, as shown by the figures, which give values exclusively and do not indicate the number of machines exported.

One curious and interesting fact in regard to the exports of bicycles illustrates the general tendency of our export trade in manufactures. This is the fact that a very large proportion of our exports of manufactures go to manufacturing countries. Two-thirds of our bicycles go to countries which make a specialty of manufacturing, and this export to manufacturing countries increases rather than otherwise. It will be remembered that predictions were made a year or two ago that the exports of bicycles to Japan would decrease as soon as the Japanese had obtained sufficient numbers as models for their own factories and had established themselves in the manufacture of wheels. This prediction, however, has not proved true. The exports of bicycles to Japan which in the fiscal year 1897 amounted to $52,179, were in 1898 $88,905, and in the fiscal year which ends next month will reach fully $130,000.

The largest single buyer of our bicycles in the fiscal year 1898 was the United Kingdom, which took $1,852,-166.

Germany's purchase of bicycles from us last year amounted to $1,724,404. Canada came next in amount of purchases in this line, the total being $611,402, while France was next with purchases amounting to $482,682; British Australasia next, $309,906; Netherlands, $251,918; Denmark, $226,370; British Africa, $148,503; British East Indies, $90,388; Japan, $88,905; China, $27,449; Dutch East Indies, $13,-368; and Africa, $11,647. To many of these distant places the exports of bicycles in the present fiscal year will exceed those of last year.

THE HEAVENS IN JUNE.

BY GARRETT P. SERVISS.

With the opening month of summer the magnificent Arcturus comes to the zenith in the early evening, say at 9:30 o'clock at the beginning of the month and before 8:20 at the end. Arcturus is sometimes referred to as a red or reddish star, but in fact it shows very little color except when it is near the horizon. When rising it often assumes a flaming appearance, owing to the unsteadiness of the air, but as it approaches the middle of the sky its ruddiness as well as its flickerings vanish, and it shines steadily with a pale yellowish light. But turn a telescope upon it, even when it is nearest the zenith, and it appears of a rich orange hue, and very beautiful. This is one of the very greatest of the stars, and even Sirius, probably, would make but a poor showing in the comparison if placed at an equal distance. In fact, some of the estimates of the quantity of light and heat sent forth by Arcturus are almost incredible, and if they are correct no planet could survive as near to Arcturus as the earth is to the sun.

While Arcturus reigns in midheaven, another star, whose actual magnitude is not much less, while it exceeds its rival in beauty, Vega, in the constellation Lyra, is the cynosure of the northeastern quarter. I have entertained a "telescope party" for an hour or more, simply by turning the glass in succession from Arcturus to Vega and back again. The contrast of their colors is delightful to look upon. To the naked eye Vega appears brilliantly white—"as white as a diamond"—but in the telescope it assumes a dazzling blue tint which is superb. The change from the deep orange of Arcturus to the piercing blue of Vega, and vice versa, is peculiarly pleasing.

A third great star whose actual magnitude, being unknown, because of its immeasurable distance, may be safely assumed as immense, Antares, in Scorpio, is seen in the southeast while Arcturus is overhead and Vega is sparkling in the northeast. Antares may be correctly enough described as a red star, and yet it, too, when on the meridian in a clear night, often appears nearer yellow than red. In the telescope its ruddy hue is pronounced, and, with a glass of four or five inches aperture, when the air is steady, the amateur observer may catch a glimpse of the little green companion of Antares, one of the most surprising of all double-star views.

THE PLANETS.

Jupiter is now so clearly the prince of the celestial legions that he should be placed first in the enumeration of the planetary phenomena of June. In the constellation Virgo, almost directly south of Arcturus, and some ten degrees east of Spica, he crosses the meridian about 8:30 P. M., in the middle of the month. Being situated south of the equator he comes more readily into view for the casual star-gazer than he would do if further north, although his southerly declination is otherwise a disadvantage. I can only repeat the advice to all owners of telescopes, however small they may be, to study Jupiter with diligence. Next to the moon there is no heavenly body whose features can be so easily discerned, and they are always interesting on account both of the variety of color and form and the gradual changes which they present. The motions of the satellites are a perpetual source of interest. I mention a few of the phenomena connected with them:

On June 5, at 8 h. 24 m. 15 s. P. M., Satellites I and II will be occulted, i. e., will disappear behind the planet, at nearly the same instant. On the 6th, between 6:32 and 8:44 P. M., the shadow of Satellite I will be upon the planet's disk; also on the 13th between 8:27 and 10:39 P. M. On the 14th, at 9:03 P. M., Satellite III will reappear for occultation, while between 7:19 and 9:39 the same evening the shadow of Satellite II will be upon the disk. On the 21st, at 9 h. 44 m. 6 s. P. M., Satellite I will reappear for eclipse by the planet's shadow. About 10 minutes later the shadow of Satellite II will pass upon the disk.

From Jupiter the observer will turn to Saturn, in the constellation Ophiuchus, rising about 8 P. M. at the opening of the month, and sufficiently elevated to be fairly well seen by 10 o'clock. The wings are widely opened, their northern face being presented toward the earth. Saturn is in opposition to the sun on the 11th, and but for its great southern declination would be well placed for telescopic study. A look at Saturn's rings with a telescope is a very convincing argument for people who are skeptical about the wonders of astronomy.

Mars will be found in Leo, setting before midnight, and too faint and far away to be interesting even for telescopic observation.

Venus is a morning star, moving from Aries into Taurus, and gradually approaching the sun. It rises soon after 3 A. M.

Mercury, traveling from Taurus through Gemini, is in superior conjunction with the sun on the 14th, becoming thereafter an evening star, and visible in the twilight about the end of the month. Mercury and Neptune will be in conjunction on the morning of the 15th.

Uranus is in Ophiuchus, rising before sunset, and Neptune is in Taurus and comes into conjunction with the sun on the 15th.

THE MOON.

New moon occurs on the 8th; first quarter on the 16th; full moon on the 23d, and last quarter on the 29th. The moon is nearest the earth on the 24th, and farthest from it on the 12th. A total eclipse of the moon occurs June 22-23, invisible in the eastern United States, but partially visible on the Pacific Coast.

The lunar conjunctions with the planets occur as follows: Venus, on the 5th; Mercury, on the 7th; Neptune, on the 8th; Mars, on the 14th; Jupiter, on the 19th; Uranus, on the 21st; Saturn, on the 22d.

MISCELLANEOUS.

The sun enters Cancer and astronomical summer begins on the 21st at 11 A. M.

There will be a partial eclipse of the sun on June 8th, invisible in the United States, except in Alaska, but visible in Europe.

THE CHROMO-CAMERA.

The chromo-camera is the name given to a new apparatus for the study of colors and colored lights. It consists of a cardboard box measuring $6 \times 6 \times 3\frac{1}{8}$ inches and open at one end. The box or camera is covered with black cloth and the interior is lined with dead black paper. A cover, also black, closes the open end. On one side is an opening $3\frac{5}{8} \times 7\frac{7}{8}$ inches, the lower edge of the opening being 1 inch from the bottom of the box. With the box are three "tinters," such as are used in color projection lanterns. These tinters are made by inclosing a film of colored gelatine between two lantern slide covers. A slide mat is placed over the film between the glass covers, and the whole is bound with paper on the edges. One of the tinters is a deep orange red, one is a yellowish green, and the other is light violet, these three tints in a color projection lantern giving a white light on the screen. There should also be with the camera a number of squares of colored papers, such as are sold in packages of assorted colors for use in kindergartens, some colored fabrics, ribbons, etc., natural or artificial flowers, and a sheet of stiff white cardboard $5\frac{1}{8} \times 6$ inches.

The chromo-camera is the invention of Mr. Charles Barnard, of New York, and was first used by him in his school lectures on the study of sense impressions of color. The color camera is used to examine the colors of objects placed in a colored light and to enable the student to mingle diffused white light and a colored light in various proportions. The invention is here described for the first time, and is freely dedicated by the author to the use of students and teachers.

To use the color-camera, place a table close to a window having a north or sky light free from reflections from buildings or trees, and cover the table with black cloth or paper. Remove the cover from the box and place it on the table with the opening uppermost and with the open end away from the light. The side curtains should be drawn together to mask the light from the eyes, leaving only a space in the center a little wider than the box. Draw the shade down to about on the line of the eyes when seated behind the table. Two or three persons can sit at the table where they can see the interior of the box. The teacher or operator should stand at one side of the table behind the curtains. Here the tinters, colored papers, etc., are in easy reach.

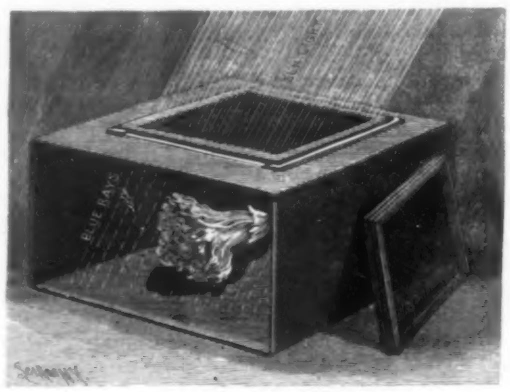
The box is now fully illuminated by the light that falls through the opening and by the reflected light that enters the open end. Place a sheet of red paper in the box. It is plainly visible. Now lay a book over the opening in the box. The red paper now appears to be almost black in the dark box.

Remove the book and paper, and place the red tinter on top of the camera near the back. Slide it slowly forward toward the light, and let the students watch the interior of the camera. When the glass fits the frame, and covers the opening, the interior of the camera appears to be of a very dark red, the color being faintly visible near the edge of the opening at the back, and fading away to dead black inside the camera. Place a sheet of white paper in the camera, and it appears a bright pink. The fingers are rosy, and a white flower is pale red. The effect will be improved by placing the cover of the box on edge just above the opening. Remove the red tinter, and the paper is again white. Place the green tinter over the opening, and the paper is a pale grass-green. Place the violet tinter on the box, and the paper is violet.

What has been accomplished? The light contains all colors. The tinters act as strainers. They shut off or strain out all colors except one. The paper capable of reflecting all colors (white) finds only one, and, therefore, reflects that one and no other. It would reflect it perfectly were it not for the fact that some white light is reflected into the back of the box and mingles with the colored light. It is this that causes the paper to appear pink under the red tinter.

Remove the white paper and put the red tinter in place. Put a red paper or red flower in the camera. It appears a deeper red. Now remove the cover from the top of the box, and let the operator hold the sheet of white cardboard upright on the edge of the box. Now gently tip it forward, and at the same time move it backward. It acts as a reflector and throws more white light into the box, and the red flower changes its shade of red, becoming lighter in shade as more white light mingles with the colored light.

Remove the flower, and place a sheet of pale yellow paper in the camera. It is now a deep golden orange, and by the aid of the reflector, the color can be made to change from yellow to orange. The same effect can be produced by sliding the tinter back to allow a thin sheet of light to enter the opening. Remove the yellow paper, and place a sheet of green paper in the camera. It appears neither red nor green, but yellow. The eye is now receiving two sensations, a sensation of red from the red light in the camera and a sensation of green from the green paper partly illuminated by white light that contains green. The compound sensation we call yellow. By sliding the tinter backward, or using the reflector, paper can be made to pass from green to yellow through many beautiful tints and shades.



THE CHROMO-CAMERA.

Place a white rose in the box, and we shall see a pink rose with yellow leaves. Place a blue flower or blue paper in the camera, and we shall see a purple flower or paper.

Put the green tinter on the camera. Now yellow paper is olive green, blue paper is Nile green, bright red paper is dark brown. A red rose is almost black-brown, while its leaves are a vivid green. Slide the tinter forward and back to observe the color change. Try the violet tinter, and under its violet light every color will suffer endless changes as the proportion of white light is allowed to mingle by means of the reflector with the colored light.

These experiments, novel and beautiful as they are, can be greatly improved by using the color camera in full sunshine. Place the table close to a sunny window in the full sunlight, the best time being between 12 and 3 o'clock. Draw the shade down till its shadow just touches the back of the camera. Now the shaders of the camera will fall on the black cover of the table, and upon it will be a square of sunlight from the opening in the box, this square of light being partly within the box, according to the position of the sun. By tilting the box up at the back it can be thrown inside the box, but if the curtains are closely drawn and the other windows are darkened, the effects can all be seen on the table outside the box.

Now all the experiments can be repeated with the most brilliant results. With the red tinter a sheet of blue paper appears a wonderful purple, green is a splendid gold color, and yellow a red orange. Every color, single or compound, will appear in marvelous brilliancy, and the students will be lost in wonder at the endless combinations of tint and shade of flowers, paper, and other materials under the magic of two lights, white light and a colored light.

Take a piece of cardboard and cut in it a small cross, star, or other figure. Lay this over the red tinter, and in the camera we shall see the figure in vivid red on a black ground. Place a green paper in the camera, and the figure seems to shine with an orange-yellow light. Try each tinter in the full sunlight, and a great variety of beautiful effects will be observed.

Next take the color camera to a good north light. Place a sheet of white paper on the bottom of the box, and upon this lay a penknife, rule, pencil or other small object. Put the object about an inch from the front of the box. The light that falls into the open box causes the object to cast a shadow on the white paper. Now place the violet tinter in top of the box, next to the front. Now let the operator move the tinter slowly backward till it covers the opening, while the students fix the attention upon the shadow in the box. When the opening begins to be closed by the tinter, the shadows deepens. A faint violet fringe appears on the edge. This grows deeper and deeper as the violet twilight in the box decreases. Suddenly, another color appears. The shadow suggests yellow, and just as the tinter closes the opening the gray shadow turns to a pale ghost-like yellow. By using the reflector the shadow can be made to turn from gray to yellow at will. With the red tinter the shadows are green, with the green tinter they are red; in each case the shadow is of the complementary color of the tinter.

Students and teachers will find the chromo-camera both useful and entertaining in the study of color. Such experiments tend to train the eye to a finer appreciation of the distinctions of color, hue and shade, and such training cannot fail to add to our enjoyment of nature and art.

A NEW GAS-GENERATING MACHINE.

In the ordinary method of generating hydrocarbon illuminating gas, a large quantity of naphtha is exposed to the evaporating action of air and is absorbed. The degree of absorption depends upon the amount of naphtha thus exposed, upon the intensity of the heat applied, and upon the quality of the naphtha. This method has its defects, chief among which may be mentioned the lack of any means for producing an absolutely uniform quality of gas, as at times the air is supersaturated and carries an excess of hydrocarbon vapor, which condenses in the pipes, and at other times the air is but partially charged, the amount of saturation varying between these points. The most volatile portion of the naphtha is evaporated, and the portion of lesser degree of volatility often remains in the apparatus, necessitating removal as a waste. The difficulties which have been encountered in filling this want of an absolutely uniform quality of gas from naphtha without waste or condensation seem to have been overcome in the gas apparatus illustrated herewith and made by the C. M. Kemp Manufacturing Company, of Baltimore, Md.

The apparatus consists essentially of a naphtha-tank, *E*, an air supply regulator, *A*, a meter-wheel, *D*, and a converter, *G*.

The regulator, *A*, is provided with a gasometer-bell, the rising and falling of which operates the blow-off valve, *B*, of a pipe communicating with a blower serving the purpose of pumping air into the regulator, *A*.

THE KEMP GAS-GENERATING APPARATUS.

The air thus applied to the regulator, *A*, passes through the valved pipe, *C*, into the meter, *D*, by which it is automatically measured into volumes proportionate to the amount of naphtha-vapor with which it is to be mixed. As the air is being measured, the meter-wheel shaft is rotated by the passing current of air, the power thus obtained being made to operate a mechanism on the front of the meter-wheel, whereby the requisite quantity of naphtha is pumped from a well-pipe connected with the tank, *E*, and provided with a float cut-off, *F*. By reason of this arrangement the quantity of naphtha fed depends upon the quantity of air passing through the meter-wheel, *D*. The air which has been measured by the meter-wheel and the naphtha are respectively conducted to the converter by the pipes, *L* and *H*.

Within the converter, *G*, a steam cylinder is mounted, to which steam is supplied by the pipe, *J*. The air conveyed by the pipe, *L*, and the naphtha fed by the pipe, *H*, and volatilized by the steam heat, are intimately mingled in the converter; and the inflammable mixture thus produced is distributed to the various burners in the building by the service pipe, *K*.

One chief point of merit of this apparatus resides in the automaticity of its operation. If the demand for gas be great, the gasometer-bell of the regulator, *A*, falls, thereby closing the blow-out valve, *B*, and causing a larger quantity of air to pass to the meter-wheel, *D*. If there be but few burners in use, the gasometer-

bell of the regulator will rise, thus opening the blow-off valve, B, and permitting the surplus air to escape. When the various burners are shut off, the machine stops, but renews its operation automatically whenever gas is desired.

In the illustration the various parts of the apparatus have been disposed in a single room; but in practice they can be so distributed and arranged as to meet the conditions of the building in which they are placed.

The amount of steam used is trifling, as there is no large body of air or naphtha to be heated, but a very small amount of naphtha at any one time requires to be volatilized in the converter.

The inventors of this apparatus claim that the gas produced is of absolutely unvarying quality, and is supplied in accordance with the amount required by the burners. The demand may be very large or very small; the service may be constant or intermittent; but the apparatus will always conform with the requirements of the consumer.

They also claim that this apparatus does as well on the last gill of naphtha as when there is a full tank supply, and that the combination of air and naphtha is such as to insure against condensation. They claim further that the naphtha is kept underground with no pressure upon it whatever and is withdrawn and conveyed to the converter through a very small pipe. The apparatus has been favorably passed upon by the insurance authorities, and is allowed to be installed in city premises even having no yard space.

The inventors state that the fuel gas made by the apparatus produces an intense and extremely cheap illumination with incandescent burners, and is designed for lighting small towns, hotels, institutions, etc., and for fuel purposes for factories, etc.

The manufacturers have other modifications of the apparatus adapting it to be operated by water service.

NIAGARA AS AN INDUSTRIAL CENTER.

At the foot of the main thoroughfare in the town of Niagara, at a point on the edge of the gorge about midway between the American Falls and the new steel bridge, is shown the spot where the first white man (so says tradition) obtained a view of the majestic falls of Niagara. That was more than two centuries ago, and Father Hennepin was so impressed with what he saw that in his book "Louisiana," published in 1683, he gave the height of the falls as being over three times as great as it actually is, putting it down as 500 feet. In 1697 he wrote his quaint work, "New Discovery," in which he gives the following oft-quoted description: "Betwixt the Lakes Ontario and Erie, there is a vast and prodigious cadence of water, which falls down after a surprising and astonishing manner, insomuch that the universe does not afford its parallel." So profound is the impression of magnitude upon the mind of the worthy father, that in a later description he adds yet another 100 feet to his former estimate, making the total height of the falls 600 feet! Its actual height is 167 feet. Father Hennepin was the first of a host of word-painters who have attempted to portray this surpassing sight—and failed. Niagara must be seen and heard; moreover, its appeal to the spectators will be as infinitely diverse as there are diverse temperaments in the multitudes of pilgrims that gather yearly at its banks from the four corners of the earth.

The present series of articles will be devoted to a description of the topographical and engineering features which are included in and suggested by the term Niagara: the river, the fall, the gorge with its overarching bridges, and the scenic railways which line its crest and follow the shore line at its base, and above all the unprecedented hydraulic and electric works by which the outflowing drainage of our great inland seas is being subjected to the service of a growing industrial city.

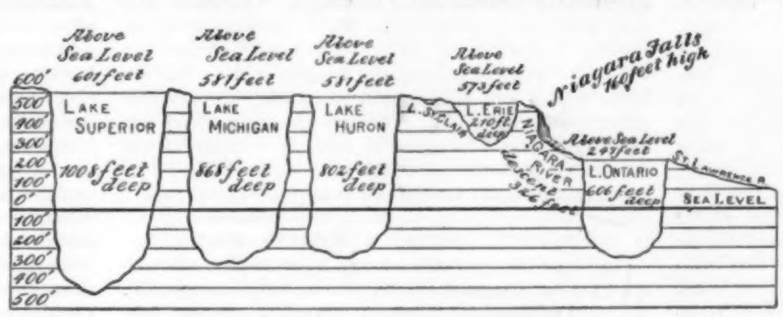
By reference to the accompanying map, it will be seen that the Niagara Falls are situated on the river of that name and about midway between Lake Erie and Lake Ontario. The river, which is 33 miles in length, flows in a general northerly direction, and in that distance it has a total fall of 326 feet, almost the whole of which occurs in the last 17 miles of its course. It forms the channel by which the whole of the drainage of the four great lakes, Superior, Michigan, Huron and Erie, flows into Lake Ontario; and as the total drainage area is 90,000 square miles and the total flow 275,000 cubic feet per second, it can be understood that Niagara is a truly imposing river. The interruption to navigation presented by the falls and rapids has been overcome by two notable canals. On the Canadian side, the Welland Canal has been cut in a northerly direction from Port Colborne on Lake Erie to Port Dalhousie on Lake Ontario (see map), and communication with tide water on the American side is maintained by the Erie Canal, which extends from Buffalo, at the entrance to the Niagara River, to Cohoes, on the Hudson River.

MAP SHOWING THE COURSE OF THE NIAGARA RIVER.

After leaving Lake Erie, the river flows somewhat swiftly for the first two miles, and then, with a slackening and widening current, divides to pass on either side of Grand Island (see map), below which it widens to its fullest breadth of 2½ to 3 miles, and flows sluggishly among numerous low-lying islands that make it look more like a lake than a river. Here the general course of the river is westerly, and it gradually narrows as it approaches the upper rapids, which extend about a mile above the falls. At this point the river enters the field of the bird's eye view embraced in our first page engraving. The total fall of the rapids is 52 feet, and, as the extreme width of the river is here 4,750 feet, the swift rush of the expanse of troubled water over its rocky bed forms a fitting introduction to the majestic falls below. About half a mile from the brink of the gorge the river is divided by Goat Island into two unequal streams, the one on the American side comparatively shallow and narrow, discharging over the precipice in what is known as the American Falls, while the major portion of the river swings around to the north and discharges over a crest of a general horseshoe form, from which it takes its name.

The American Falls are 1,060 feet in width, with an estimated maximum depth at the crest of 8 feet, and a vertical fall of 167 feet. The Horseshoe or Canadian Falls have a total width of 3,010 feet, a maximum estimated depth of 20 feet, and the vertical height is 158 feet. It is a singular fact that the amount of water which passes over the falls is practically constant, and what variations there are, are not caused by rainfall, snow, or changes of temperature, but are dependent upon the prevailing winds, which, if they blow strongly and alternately from certain opposite quarters, back up and then release the waters of Lake Erie and greatly increase the depth of the water at the falls for the time being. The normal flow, according to the gagings of the United States engineers, is 275,000 cubic feet per second, or about half a million tons per minute. The total fall available for power purposes from the commencement of the upper rapids, where the power companies have their intakes, to the river immediately below the falls is 216 feet, and this shows the theoretical horse power of the falls to be about 6,750,000. If we include the additional fall of 100 feet from the foot of the falls to Lewiston, 8 miles below, we find that the theoretical possibilities of Niagara must be put down at 10,000,000 horse power.

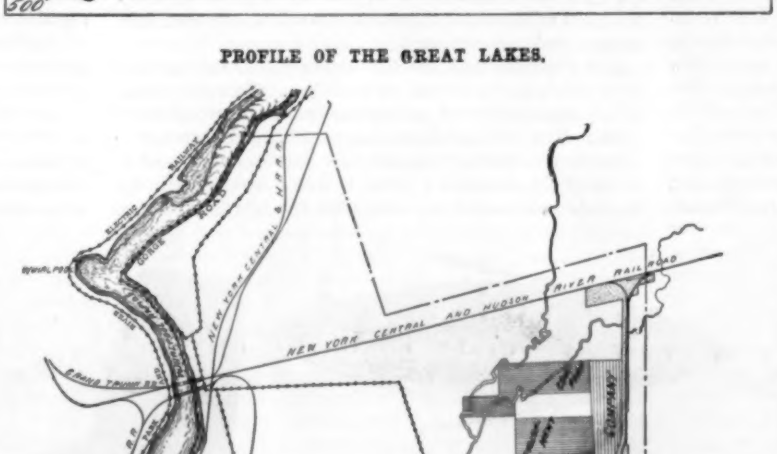
There is no great depth of water underneath the American Falls, indications being that its bed is full of massive and broken rock; but the enormous mass of water (estimated at from four-fifths to nine-tenths of the whole) that thunders over the Horseshoe Falls with a depth at the center of 20 feet, has excavated a basin and channel that is fully as deep as the falls themselves. The river maintains this depth, from shore to shore, for a mile and a half or more below the falls, shallowing gradually as it approaches the cantilever bridge of the Michigan Central Railroad. The enlarged cross section of the channel has the result of slackening the stream, so that it flows very sluggishly through this part of its course, so much so that small row-boats do not hesitate to cross from shore to shore. At the new steel arch railway bridge the river begins to fall with great rapidity over an extremely rocky and uneven bed, the fall extending for about a mile. As the gorge at this point narrows considerably, the confined waters rush down tumultuously at an estimated speed of 30 miles an hour, and the effect, as one stands at the bottom of the gorge and close to the edge of the mighty torrent, is even more inspiring than that of the falls themselves. The 10,000,000 horse power, the 30,000,000 tons per hour, and other figures of Niagara seem very conservative when one is standing on the edge of the Whirlpool Rapids.



PROFILE OF THE GREAT LAKES.

At the foot of the rapids is the Whirlpool, where the river takes a sudden turn of about 90 degrees to the right. The onslaught of the river against the opposing cliffs, assisted by a natural depression, has worn out a vast circular basin into which the waters of the rapids rush, and form the celebrated Whirlpool. From the Whirlpool the river flows through a broadening and less precipitous channel, until it passes between the picturesque towns of Lewiston and Queenston, to broaden into a wide channel for the rest of its journey to Lake Ontario. The fall in this last seven miles of the river is about half a foot to the mile.

By studying our front page view of Niagara, our readers will see that the river appears to have cut its way back from Lewiston through an elevated and generally level country, and this impression is confirmed by a study of the actual locality. Coming up the river from Lake Ontario, one notices that the surrounding country is low and fairly level, but at Lewiston there is a lofty and somewhat precipitous escarpment or bluff, the ground rising to a height of 374 feet above



THE INDUSTRIAL DEVELOPMENT OF NIAGARA FALLS.

the lake level. This high level is maintained with slight undulations up to the falls. The indications are that the latter were originally located at Lewiston and Queenston, and have, in the course of ages, cut their way back to their present position. The depth from the crest of the gorge to the river varies from 200 to 300 feet, and its width from 1,500 feet at the falls to 220 feet at the lower end of the Whirlpool rapids.

In subsequent articles we shall deal with the engineering and industrial features of Niagara Falls, and it will be sufficient at this time to briefly indicate these features as shown on the accompanying bird's eye view of the river and its environs. The depth and turbulence of the river have necessitated some costly and difficult bridge work. About a quarter of a mile below the American Falls is the Niagara Falls and Clifton arch bridge, built last year to replace the suspension bridge which for many years was a familiar feature of the landscape. This is the longest arch bridge in existence (868 feet span), and to our thinking is the most beautiful of its kind in the world. A mile and a half below we come to the cantilever bridge which carries the tracks of the Michigan Central Railroad, and forms a link in the great trunk system of the New York Central Railroad between New York and the West. Closely adjoining it is the new steel arch bridge completed last year, replacing the old railroad suspension bridge on the same site. It carries the tracks of the Grand Trunk Railroad, and so forms a link in the route of the Canadian Pacific system. A few miles further down the river the new Lewiston and Queenston suspension bridge is in course of erection; and when completed it will form an important element in an electric belt line which will extend the full length of the gorge on either side, crossing it to the north at Lewiston and to the south by way of the Niagara Falls and Clifton bridge already referred to. Fuller details and illustrations of these bridges will be given in a subsequent issue.

Ever since the year 1725, when a small sawmill was erected at the falls, their vast store of energy has appealed to the mechanical instincts of man and invited his co-operation; but it is only of late years that any serious attempt has been made to utilize this energy on a large scale. By far the largest modern plant is that of the Niagara Falls Power Company, whose canal and power house is situated about a mile above the American Falls, and therefore above the upper rapids, as shown in our front page engraving. The water is led in from the river by a canal which is 12 feet deep by 180 feet long, and of sufficient capacity to deliver water for the generation of 100,000 horse power. At the side of the canal is a huge wheel pit, 30 feet wide by 200 feet long and 180 feet deep. Water is led from the canal to the bottom of the pit by eight steel penstocks, each 8 feet in diameter, and at the base of each penstock is a 5,500 horse power vertical turbine. Each main shaft carries at its upper end, within the power house, a 5,000 horse power generator, the total capacity of the plant, as now established, being 40,000 horse power. Provision is made within the pit for two more turbines, the total proposed capacity of this house being 50,000 horse power. Another power house of equal capacity is shortly to be built on the opposite side of the canal, and the company has franchises which will allow it to erect a 250,000 horse power plant on the Canadian side when it is prepared to do so. The tail race of the present power house is carried through a tunnel 7,000 feet in length, which was driven from the bottom of the wheel pit in a straight line beneath the town of Niagara Falls to an outlet at the base of the cliffs just below the abutments of the upper arch bridge. The outlet is marked on the bird's eye view on the front page. The Niagara Falls Paper Company, whose works adjoin the power house of the Niagara Falls Power Company, utilize 7,200 hydraulic horse power, taking the water from the canal and discharging into the tunnel.

Next in importance is the Niagara Falls Hydraulic Power Company. It owns a canal, shown on our engraving, which leaves the river at a point above the rapids and 2,000 feet below the canal of the Niagara Power Company, and runs through the town to a basin situated near the edge of the gorge and a quarter of a mile below the upper bridge. Here it is led by two penstocks, one 8 feet and the other 11 feet in diameter, to a power house 200 feet below at the edge of the river, where its energy is developed in a series of horizontal turbines. The present installation represents a capacity of 10,500 horse power, and this is to be increased shortly to 20,000 horse power. By extending the terminal basin northward along the cliffs, enlarging the canal and building another power house at the river level, below the present small users of the canal water, it is proposed to develop 100,000 horse power. The franchise allows the company to develop 125,000 horse power from the river.

The canal, which was built in 1858, also supplies a number of industrial works which utilize only a part of the available head of 210 feet. Most of the turbines operate under a head of from 60 to 100 feet, and about 7,500 horse power is developed in this way. The tail race discharge is through a tunnel or through an open cut in the face of the cliff.

On the Canadian side, the Niagara Falls Park and River Railway has a power house opposite the Horseshoe Falls in which are two turbines working under a 68 foot head, with a combined capacity of 2,000 horse power.

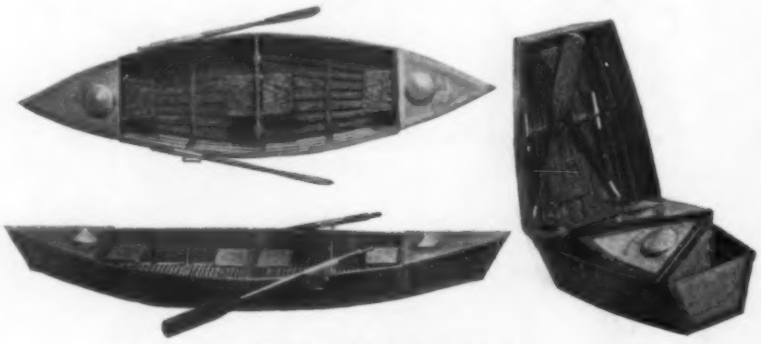
Including then all the various users of the Niagara River waters for power purposes, we find that at the present writing, of the total theoretical horse power of 7,500,000, less than 50,000 horse power is being actually developed and turned to useful account. The contracts already made by the two great power companies call for an increase upon this of about 60 per cent.

The accompanying map of Niagara shows the various lands acquired by the companies, which they propose to rent out to such industrial concerns as wish to locate on their property and use the companies' power. Of these companies, the Niagara Falls Power Company alone own 1,071 acres, while the Niagara Falls Hydraulic Power and Manufacturing Company own 70 acres, as indicated on the map. The industries already established and using the electrical power are very numerous, and include the manufacture of paper, aluminum, carborundum, calcium carbide, peroxide of sodium, and other chemical industries. The street railway systems of Niagara, the Gorge railways and the railway to Buffalo, 22 miles distant, are operated by electricity generated from the Niagara waters, Buffalo alone taking 6,000 horse power for its city railroads and other power purposes. The present indications are that industries will move to Niagara instead of the electricity generated at the falls being transmitted to any great distance for industrial purposes.

A NOVEL PORTABLE FOLDING BOAT.

An improved portable folding boat has been invented by John Osmond, 921 W. 12th Street, Chicago, Ill., which is adapted for the use of travelers, hunters, fishermen, and prospectors.

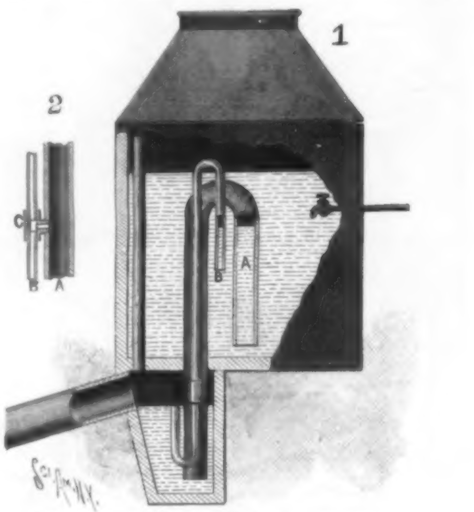
Our illustrations show the boat with its folding and removable parts in various positions. The boat comprises essentially two middle sections and two end sections. The two middle sections are hinged together so they may be folded together, one section being used as a cover for the other. The two end sections are detachably connected by bolts with the middle sections, so that they may be placed within the middle sections when not in use. In order to lock the two middle sections together when they are extended, bolts are used which are provided with washers to prevent leakage. When the four sections are in position and bolted together, a complete boat is formed having pointed ends constituting buoyant air-chambers. The end sections, when not in use, are placed within the middle sections, and serve as storage compartments for provisions. The seats of the boat are so hung that when the parts are folded, they may be swung out of the way. The oars, in order to be readily stored in transportation, are made in detachable sections.



OSMOND'S PORTABLE BOAT.

AN AUTOMATIC SIPHON.

A patent was recently issued to Charles F. L. McQuistion, of Butler, Pa., for an automatic siphon especially adapted to the flushing of sewers and drains where the flow of water is small or intermittent. Fig. 1 is a partial section of the device; and Fig. 2 is a detail showing a portion of the siphon and of a vent-pipe employed.



McQUISTION'S AUTOMATIC SIPHON.

The siphon, *A*, discharges into a trap or water-seal. A vent-pipe, *B*, similarly bent to the siphon, *A*, has its lower end within the trap and above the siphon-discharge, and its upper end above the bend of the siphon. The upper end of the vent-pipe is located above the siphon-intake and below the siphon-bend, a distance exceeding the depth of the seal at the lower upturned end of the vent-pipe. As shown in detail in Fig. 2, the vent-pipe, *B*, and the siphon, *A*, are connected by a passage running through a fitting, *C*.

The upper portions of the vent-pipe and siphon are arranged in the water-collecting tank. As the water rises in the tank, it enters the intake of the siphon, *A*, until it reaches the level of the upper end of the vent-pipe, *B*. As the water rises, the air in the pipes is compressed, but is prevented from escaping by the water-seals at the discharge ends of the pipes. A continued compression of the air by the rising water will finally blow out the water-seal at the lower leg of the vent-pipe, thus causing the water rapidly to rush into the upper ends of the pipes and to empty the tank.

Should it be so desired, the upper part of the vent-pipe can be omitted; but in this case the compression of air begins immediately upon the rise of the water in the tank.

The Removal of Tattoo Marks.

In the Archives de Médecine Navale for October there is an instructive article by Dr. Félix Brunet, a junior surgeon of the French navy, on Détatouage, or the art of removing pictorial designs and inscriptions from beneath the outer skin. Soldiers and sailors—the latter especially—are notoriously fond of this species of adornment, but men at best are but fickle creatures, and with advancing years many among them become anxious to be relieved of the too persistent records which they then no longer look upon as ornamental. As Dr. Brunet says, there are few naval medical officers who have not been asked by patients to remove tattoo marks: but, unfortunately, when their services are thus required they are obliged to depend upon their own resources, as little or no information is afforded by the text-books.

It is true that an immense number of methods have been recommended, both in ancient and in modern times, but all are more or less inefficient, while many of them are barbarous. Tattooing varies so considerably as to site, extent, and depth that no single method, however elastic, can possibly answer in all cases. Dr. Brunet enters into an elaborate historical survey of his subject, exhibiting a vast amount of erudition. Among other stories he tells once more how Bernadotte died rather than lay bare his arm for phlebotomy. In his salad days Napoleon's famous general had been an ardent republican, and had he consented to the uncovering of the limb, an elaborate design attesting to his unalterable devotion toward the Republic One and Indivisible would have come to light.

In conclusion Dr. Brunet formulates his procedure as follows: "The empirical means proposed for the removal of tattoo marks being either inefficacious or dangerous, while the scientific expedient of repricking with various caustics is insufficient, we propose a method, more complicated but surer, and separable into the following stages: (a) delimitation of site to be operated on by diachylon plaster, anæsthesia by cocaine; (b) vesication by ammonia; (c) removal of epidermis, free rubbing of exposed design by nitrate of silver pencil; (d) after five minutes' salt or boricated water dressing, to be renewed the next day, when also the diachylon may be removed; (e) cicatrization under powder formed of equal parts of iodoform, red bark, charcoal, and salicylate of bismuth. This method is not applicable to all cases. Sometimes, notably in tattooing of the face, dissection is the best treatment. When a very large design is in question, it can be dealt with piecemeal." The method would probably be drastic, but whether its author is quite consistent in reflecting upon the barbarity of other processes while recommending his own is open to question. Any such method certainly should not be attempted except under the direction of a surgeon.

BEER tabloids are to be put on the market in Germany. It is said one of the small tablets dropped in a glass of water will, in a few moments, turn it into a glass of beer.

Correspondence.

New Exciting Fluid for Carbon Cylinder Cells.

To the Editor of the SCIENTIFIC AMERICAN:

I have recently been experimenting with the carbon cylinder battery, with a view to improving it. The exciting fluid now used is sal ammoniac (ammonium chloride), and from its being a salt it does not act with sufficient energy upon the zinc, and is only a moderate conductor of electricity, producing two results, internal resistance and low ampere discharge. The exciting fluid to a battery in order to make its use efficient must have the following properties: First of all, it must be cheap. Second, it must be a substance that can be easily transported. Third, it must have a good conducting power and not form corrosive fumes. Fourth, it must not attack the zinc on open circuit.

The substance that I have found to answer all these requirements is potassium hydroxide (caustic potash). When a carbon cylinder cell is filled with a 75 per cent solution of caustic potash, and the circuit closed, the zinc forms zinc hydroxide, which is immediately dissolved in the excess of caustic potash in proportion to the amount of current used; the zinc hydroxide being soluble, the formation of any precipitate is prevented.

In practice I set up a cell as follows: Dissolve 1 pound of commercial caustic potash in 3 pounds of water. Pour this in the glass jar to about ¾ of its capacity, then place the cylinder in the jar and pour about 2 ounces of coal oil on top of the solution and then insert the zinc. The coal oil should not be omitted, as it prevents the formation of creeping salts and keeps the caustic potash from absorbing water and carbon dioxide from the air. A battery set up this way will work perfectly on open circuit without local action, and can be used on closed circuits from three to four hours where the external resistance is not less than 3 to 4 ohms. In summing up, you can be safe in using the cell on any intermittent circuit, where it can be trusted to remain in good condition as long as the zinc lasts, as there is no loss from evaporation.

One cell using caustic potash will give current equivalent to four using sal ammoniac, as the internal resistance is reduced to a small fraction of an ohm. The voltage remains about the same, but the ampere discharge is quadrupled. RANDOLPH BOLLING.

Stokes, Va., April 10, 1899.

[The principal objection to this battery is the use of a strong caustic potash solution, which would necessitate careful handling, and placing the battery where the solution could not accidentally injure carpets or furniture.—EDS.]

Some Interesting Inventions.

An electric cellar torch has recently been patented by an Englishman, and it admits of many uses. He was the son of a physician, and quickly recognized that the principle of his father's laryngoscope might be very well applied to commercial purposes; and his experiments based on this idea resulted in the production of a clean, odorless, and reliable appliance for the thorough examination of brewers' casks and vats, cans, etc. It consists of an electric lamp covered with a long glass protector, and it is secured at the end of a handle through which the insulated wire is carried. A small mirror is provided; this folds inward when it touches the side of the cask or jar, and thus reflects the interior in such a way that it may be thoroughly examined.

That a drinking glass may communicate disease is now admitted by all sanitarians, and the persons who are compelled to make use of public drinking fountains may relieve their minds to a great extent of the fear of the infectious microbe by supplying themselves with the lip guard and protector which has recently been patented by a Boston inventor. It consists of a metal or rubber shell which slips over the edge of the drinking glass and is held in place by the natural spring of the material. This prevents one's lips from coming in contact with the edge of the glass and thereby avoids infection.

A Washington inventor has devised an ingenious attachment for a mail box. Every time that the door is opened by the collector of the mail a small movable sign is changed. This sign, which consists of a card, is visible from the outside, and shows when the next collection will be made. There is often considerable satisfaction to know when a letter which has been posted will be collected and started on its way. Mail boxes with small windows with a card showing the time of the next collection have been used for many years.

A Canadian inventor has devised what is termed "The Automatic Second," for use at prize fights. It is intended to simplify the work of the seconds in the two corners, and consists of a hollow iron pillar, to which are attached swinging brackets carrying a seat for the pugilist, a basin, and an electric fan. It is arranged so that all three can be swung outside the ropes when not wanted. The device is an ingenious one, and it is the last subject which one would naturally suppose would claim an inventor.

Miscellaneous Notes and Receipts.

Protecting Gelatine Capsules from Dampness.—According to an English patent by Valentine, they are, either before or after filling, treated with an alum solution, which is said to protect them from injury by moisture at ordinary temperatures.—Neueste Erfindungen und Erfahrungen.

Carbolic acid in the form of lozenges is prepared by melting on the water bath phenol 95 parts and stearine soap 5 parts. This mass is poured into cold moulds, and after solidifying, cut and divided as desired. The lozenges keep well and are readily soluble in water.—Neueste Erfindungen und Erfahrungen.

"Brilliant Khelidophage," a medium to clean, shine, and polish copper at the same time, consists of 1 part (by weight) of 40 per cent hydrochloric acid, 5 parts of finely powdered Venetian tripoli, and 4 parts of water. Another mixture is composed of tartaric acid 4 parts, tripoli 4 parts, and water 5 parts. With these agents the article to be cleaned is coated by means of a cloth rag, rubbing it with a dry cloth until it shines nicely. By reducing the quantity of water, the above composition can be made in the form of a paste.—Edelmetall Industrie.

Regenerating Vulcanized Soft Rubber.—The purpose of this process is to render rubber waste or old rubber articles of use again. This is accomplished by dissolving the material and separating it again from the solution. Suitable solvents have been found to be aniline, toluidine, xylidine and their higher homologues, at temperatures of 140° to 180° C. After the solution has taken place, dilute acid is added, whereby the organic bases remain dissolved as salts in the aqueous liquid, while the rubber is eliminated in the form of a tough mass. It is separated by decanting, washed and dried. The solvents employed may also be removed by the admixture of alcohol. According to Neueste Erfindungen und Erfahrungen, caoutchouc is recovered, neither devulcanized nor even only undissolved, by this process, which is patented in Germany by the Deutsche Gummi Gesellschaft.

Treating Maple to Imitate Rosewood.—To imitate rosewood, maple is best employed, since its texture approaches that of the rosewood the closest. According to Deutsche Drechsler Zeitung, the maple board must be carefully rubbed down, a handsome color being obtained only if this is attended to. For staining use anilic acids, a dark red one consisting of roseine 10 grammes, coralline 10 grammes and aniline brown 1·5 grammes dissolved in 1 liter of alcohol, and a pale red one which is obtained by dissolving roseine 10 grammes and coralline 10 grammes in 1 liter of alcohol. With this pale red liquid draw the veins on the maple-plate in distances of about millimeters, using a repeatedly divided brush, and fill up the intervening spaces with the dark red mixture. Before drying is completed, blend the light and dark stripes with a soft brush, so that they do not appear too sharply defined.

Red Enamel Color.—The ordinary red vitrifiable color in various shades is obtained by an equally heated mixture of ferric oxide and any alumina compound. It is generally produced in factories, since it plays an important part in practical enameling. The different shades are obtained by changing the proportion of the two fundamental bodies; thus a mixture of 10 parts of green vitriol and 30 parts of alum gives a coloring agent which imparts a flesh tint to the enamel. In order to produce a purple color in the enamel (and all other vitreous pastes) gold chloride in various compounds is employed. The exceedingly high price which this coloring medium naturally commands is somewhat offset by its being uncommonly productive, hence it need only be employed in small quantities. Nevertheless, this purple pigment is, by far, the most expensive material of the enameler, a kilo of the purple-glass from Geneva costing about 350 florins. The preparation of this coloring agent is carried out in different ways, according to the admixture which is made to the gold chloride. Sodium-gold chloride is produced by dissolving ducat gold in so-called aqua regia (mixture of nitric acid 1 part and hydrochloric acid 4 parts) in a lukewarm water bath. Evaporate the solution, which is carefully separated from any residues of silver chloride, in a porcelain dish to dryness. Mix the dried gold chloride with pure cooking salt (¼ part by weight of the gold originally employed), dissolve the mixture in water and evaporate again. For tin chloride-gold chloride, the gold chloride procured by the above mentioned directions is again dissolved in water. Then add a solution of tin chloride, wash the resulting precipitate on the filter and dry. The so-called Cassius gold purple, formerly almost exclusively employed for giving enamels and other vitreous compositions a purple color, is prepared by making an admixture to the dissolved gold chloride, containing both tin protochloride and tin perchloride. Since the production of this coloring agent is difficult and laborious, we will abstain from giving the different receipts and refer to the special text books, such as the works of Randau and Ferd Luthmer.—Die Edelmetall Industrie.

Science Notes.

A 12-inch shell, fired from one of the American battleships during the blockade of Santiago, exploded recently while being handled at Santiago, demolishing a building and killing three persons.

A vineyard on the Moselle which contained only one acre of ground recently sold for $60,000, which is the highest price ever paid for vine land in the Moselle territory or probably in the whole Rhine district.

Austria has profited by our experience in the Spanish war and now owns an ambulance ship named the "Graf Falkenhayn." It was fitted up and presented to the government by private gentlemen to commemorate Emperor Franz Josef's jubilee. It will be managed by the Austrian Red Cross Society.

The editor of the American Journal of Pharmacy, remarking upon the immunity of certain domestic animals against particular poisons, suggests that medicinal roots, fruits, and seeds, being rich in nutritive materials, may economically be turned to account as food for animals instead of being thrown away as being of no value after their medicinal constituents have been extracted.

In opening Great Marylebone Street, London, to lay electric cables, workmen came across several elm tree water pipes in a fine state of preservation, although they were only a few feet below the surface. These tree trunks bored through were over two hundred years old and must have been a part of an old water conduit. The pipes were blocked with silt, but otherwise were quite usable.

Prof. Marconi has invented an instrument for ascertaining a ship's position in a fog, when it is within range of one of the telegraph stations. It consists of a receiver which can be revolved and which, when pointing toward the transmitting station, sets off an electric bell, thus establishing the bearings as accurately as a compass can. The instrument is to be tried on the Channel steamers.

Philadelphia is to have a new park, to be entitled the League Island Park. It will consist of three hundred acres of low-lying land on the Delaware River, near League Island. The successful plan for the new park was drawn by Samuel Parsons, Jr., and includes lakes, meadows, ball grounds, gardens, footpaths, equestrian and carriage roads, arbors, bridges, and restaurants. The place is laid out most admirably.

A Springfield concern has recently built a number of traction engines for use in Cuba. One of these is said to have transported a paying load of sixty tons at the rate of five miles per hour upon the natural soil of the country. The engine has three high-pressure cylinders mounted on top of the boiler and drives the rear wheels by a single reduction gear. The wheels are composed of steel plate disks cut away so as to form spokes and having angle iron rings to which the broad steel tire is riveted.

According to The British Architect, the Thames Iron Company, who are now constructing the Cape Central Railway, have contracted to finish the line from Haifa to Damascus (some 120 miles), crossing the Jordan by a stone bridge and skirting Lake Tiberias. Damascus has about 300,000 inhabitants and lies in an oasis fed by two streams from Lebanon. The company will also construct a breakwater in the bay. The line will eventually go on to Bagdad and form part of a trunk route to India. A narrow gage line from Beyrout already reaches Damascus.

At the Geographical Congress at Berlin, this summer, the languages to be used will be limited to English, French, German and Italian. A writer in the review published by the Madrid Geographical Society protested against the exclusion of the Spanish language in view of the fact that it was spoken by most of the discoverers and colonists of a large part of the world. It says if more geographers were able to read Spanish they would not from time to time bring forth facts as new which were printed in Spanish books two or three centuries ago.

It seems pretty well authenticated that the human voice is capable of starting an avalanche. James Perchard, Clerk of the State Court of Appeals of one of our Western States, was mining some years ago in a mountainous region. The snow had fallen to an unusual depth, and miners moving from one cabin to another were warned to look out for slides. He stopped on one of his trips at the cabin of an acquaintance and took dinner with him and his wife. At the close of the meal his host urged him to stay awhile, but he felt nervous and started on his journey. Crossing the canyon, he looked back at the cabin where the man and his wife were standing at the door. He waved his hand and shouted goodbye. Hardly had the echo of his voice died away before a muffled noise struck his ear—a noise like the boom of a cannon—and in five seconds the cabin was buried under fifty feet of snow. Assistance was summoned, and finally the two dead bodies were taken out. There is little question that under certain conditions the vibrations of the human voice will produce an avalanche.

THE OLD LINE-OF-BATTLE SHIP "PENNSYLVANIA."

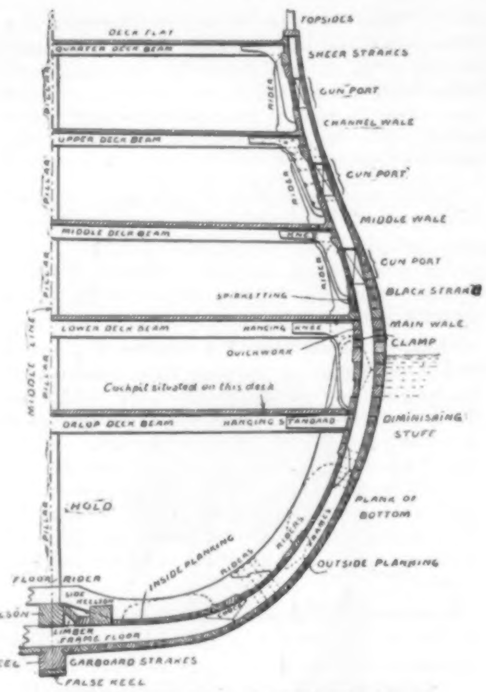
Our sense of the marvelous has been so dulled by the swift-succeeding triumphs of naval science that few of us realize, if we ever stop to think, what prodigious strides have been made in the past half century of warship construction. It is only at such a time as the present, when, with the tumult of battle still in our ears, we turn from the sight of our swiftly moving and destructive modern fleets to the contemplation of the sluggish wooden frigates and three-deckers from which our forefathers fought the enemy, that the full force of the contrast comes home to us. Yet it must be admitted that while in speed, fighting power, and defensive qualities the modern ship of steel is incomparably superior to her wooden prototype, in point of picturesque beauty the older type is beyond comparison.

Of her type and time, the old line-of-battle ship "Pennsylvania," launched after fifteen years of building in Philadelphia, on the sixteenth day of July, 1837, was the grandest example ever built by this government, and, as it turned out, was a luxury too dear for fitting maintenance; for excepting her brief cruise of five days from Philadelphia to sea and into Norfolk, her years of usefulness were spent in performing the prosaic duties of a receiving ship.

The accompanying drawing of this noble ship was made from the original plans on file at the Navy Department; those who are familiar with the subject will agree that it is one of the most successful representations of a three-decker under full sail that has ever appeared. Built of wood throughout, 210 feet in length, 58 feet of beam, with bows as bluff as her seamen's ways; her sides of heavy oak, proof at a mile to her own gun-fire, varying in thickness from 18 inches at the spar deck to 32 inches at the waterline, and pierced upon her four fighting decks by one hundred and twenty smoothbore, muzzle-loading cannon; with two full acres of canvas spread out aloft on masts that were as long as herself; designed for a complement of over eleven hundred souls—she must, in truth, have been a sight to gladden a sailor's heart as she bowled along under royal stunsails, her bulwarks bristling with cannon, her bulky sides aswell as if with conscious dignity as they bore aloft her tapering masts that towered heavenward glistening with their pyramids of whiteness.

In days when wood was the material of construction, it was no easy task to build the hull of a ship of nearly 5,000 tons displacement which should be capable of mounting a battery of 120 guns, and carrying aloft some two acres of canvas. Although only the best selected oak was used, the various timbers of the hull had to be of enormous size, and the impossibility of securing single sticks of the length required led to an elaborate system of splicing and scarfing, the joints being arranged so that as few as possible would occur in any given section through the vessel.

The accompanying diagram, for which we are indebted to London Engineering, shows the method of construction of Nelson's flagship, the "Victory," on which he lost his life while leading his fleet to victory at the memorable battle of Trafalgar. It is fairly representative of a first-rate of the early part of this century, and gives an impressive idea of the great massing together of timber that was necessary to give the needed strength. Even as it was, the old men-of-war showed structural weakness, frequently hogging at the ends—the old "Victory" herself, now stationed at Portsmouth, England, being fully 12 inches lower at the ends than in the middle. It will be seen that the cross section of the hull, especially of the submerged portion, varies greatly from that of a modern warship. The flat floor extends only about 8 feet on either side of the keel, when the hull begins to round up in a great continuous sweep to the level of the middle deck, the sides having a "tumble-home" of 7 feet from the waterline to the quarter-deck. From the middle deck the contour of the sides is concave. This form above water was discontinued when the era of the steel ships came in; but it has been revived in the French navy, and is seen in a very pronounced form in our own "Iowa" and "Brooklyn."



CROSS-SECTION OF A THREE-DECKER.

The keel consisted of massive single timbers 20 inches square, and was laid in as great lengths as were procurable. The frames were 18 inches deep in the floor, 12 inches at the waterline, and 8 inches at the quarter-deck. The hull was double-planked, the outer planking being 6 inches thick on the floor and bilges, from which it increased gradually to 12 inches at the waterline, reducing again to 6 inches at the middle deck, above which it was 4 inches in thickness. The inner planking varied from 4 to 8 inches, the latter being the thickness at the waterline. Upon the inner planking was laid a system of "riders," which varied from 12 to 18 inches in depth, and extended around the interior of the hull, forming a sort of interior framing, adding immensely to the strength and stiffness of the structure. The whole shell of the ship thus laid together was secured by innumerable bolts and treenails, the bolts being from 3 to 4 feet long and passing from the outside planking to the inner face of the riders. The treenails were long oaken pins, which were driven through the frames and both layers of planking, and were secured in place by splitting their ends and driving wedges tightly into them.

The various decks were carried on oak beams which varied in depth from 16 inches on the orlop-deck to 10 inches on the quarter-deck. Support was given to the beams amidships by massive oak pillars, a row of which extended continuously down the center of each deck. At the sides the beams rested upon chocks which were bolted to the frames. The hull was stiffened against distortion or racking in a vertical plane by "hanging knees," massive vertical angle pieces of oak, which were bolted to the beams and to the sides of the hull, and similar stiffening was afforded in the plane of the decks by a system of knees that tied the beams to the sides of the hull and lay flat against the under side of the deck. All the bolts holding the knees to the sides passed through to the outer planking.

There were five decks, named as shown in the

From a drawing by R. G. Skerrett.

THE OLD LINE-OF-BATTLE SHIP "PENNSYLVANIA."

Dimensions: Length, 210 feet; beam, 58 feet; draught, 25½ feet; freeboard, 32 feet; sail spread, over two acres; height of main truck above waterline, 210 feet; width from tip to tip of lower studding sails, 198 feet. **Displacement,** about 4 700 tons. **Maximum Speed,** 12 knots. **Complement,** 1,100 officers and men. **Protection:** Sides, 32 inches oak at waterline, 18 inches at spar deck. **Armament:** Sixteen 8-inch shell and one hundred and four 32-pounder shotguns. Maximum effective range of guns, 2,000 yards. Launched July 16, 1837.

diagram. The battery was disposed in broadside upon the upper, middle, and lower decks, the last named being the strongest deck and devoted to the heaviest guns. The orlop-deck was used as the "cockpit," or operating room, during an action, its location below the waterline rendering it safe from the enemy's shot. It was a dismal quarter, faintly illumined by the light of a few small dead-lights, assisted by the horn lanterns in vogue in those early days.

The guns were mounted on rude wooden carriages, and they were traversed and run up to the firing position by means of rope tackles secured to eyebolts in the deck and sides of the vessel. Solid shot was used against the hull and chain shot against the rigging. At close quarters the guns were usually double or even treble shotted, while grape-shot was used with deadly effect in sweeping the crews away from the guns.

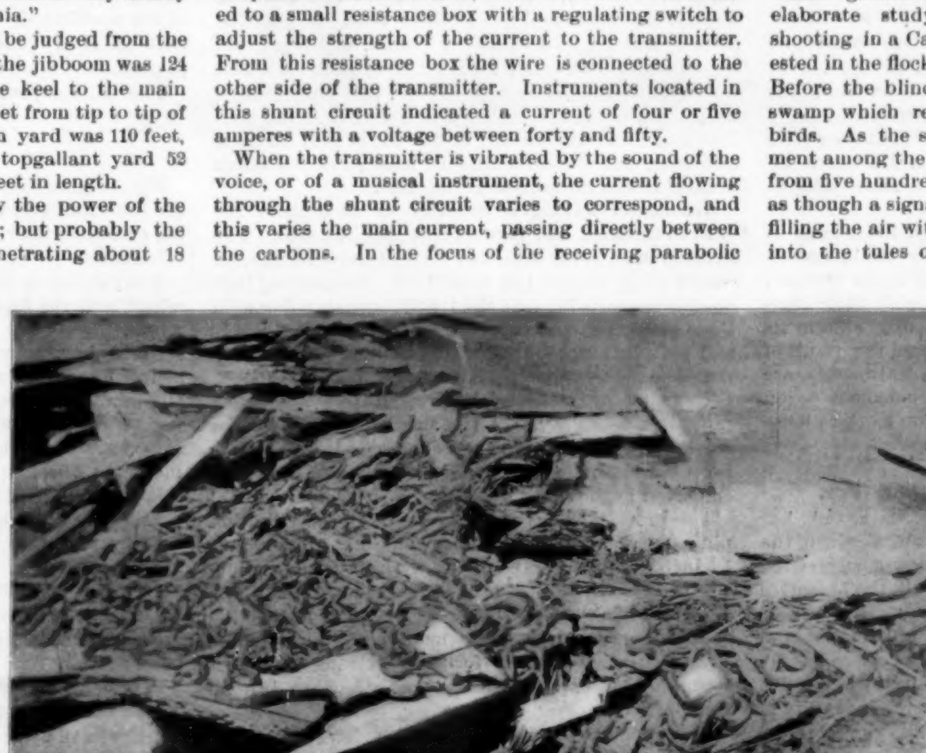
The crowded condition of the decks on ships like the "Pennsylvania," which carried over 1,100 men, involved a frightful carnage when ships were fighting at such close quarters that the muzzles of the guns frequently touched the sides of the enemy's ship. The maneuvering was mainly directed to gaining and keeping the "weather gage" (to windward) of the hostile fleet, and the most destructive work was done with a raking fire. To rake the enemy it was necessary to sail past his bow or stern (preferably the latter) and pour in a broadside down the full length of crowded decks. In some of the most fiercely contested battles a single ship would lose as many as 500 men.

One of the most striking features of the old battleships was their enormous sailspread, the "Pennsylvania" having over two acres at her disposal. The masts and yards were of vast dimensions, such as are never seen in the present day. Not content with yards that were in some of the French ships 120 feet in length, smaller spars, known as stunsail yards, were fitted to slide out in iron rings secured on the ends of the yards and thus extend the stretch of the sails by as much as 70 to 90 feet. The stunsails are shown very clearly in the drawing of the "Pennsylvania."

The great size of her spars may be judged from the following dimensions: The end of the jibboom was 124 feet from the cutwater. From the keel to the main truck was 235 feet, and it was 198 feet from tip to tip of the main studding-sails. The main yard was 110 feet, main topmast yard 82 feet, main topgallant yard 52 feet, and the main royal yard 36 feet in length.

It is impossible to state exactly the power of the old smoothbores of that early day; but probably the 8-inch guns were capable of penetrating about 18 inches of oak at 1,300 yards, and the 32-pounders 24 inches. The maximum effective range was less than 2,000 yards. The rate of fire depended largely upon the rig of the carriage and training of the crew, and it is safe to say that the average fire was not more than one shot per minute.

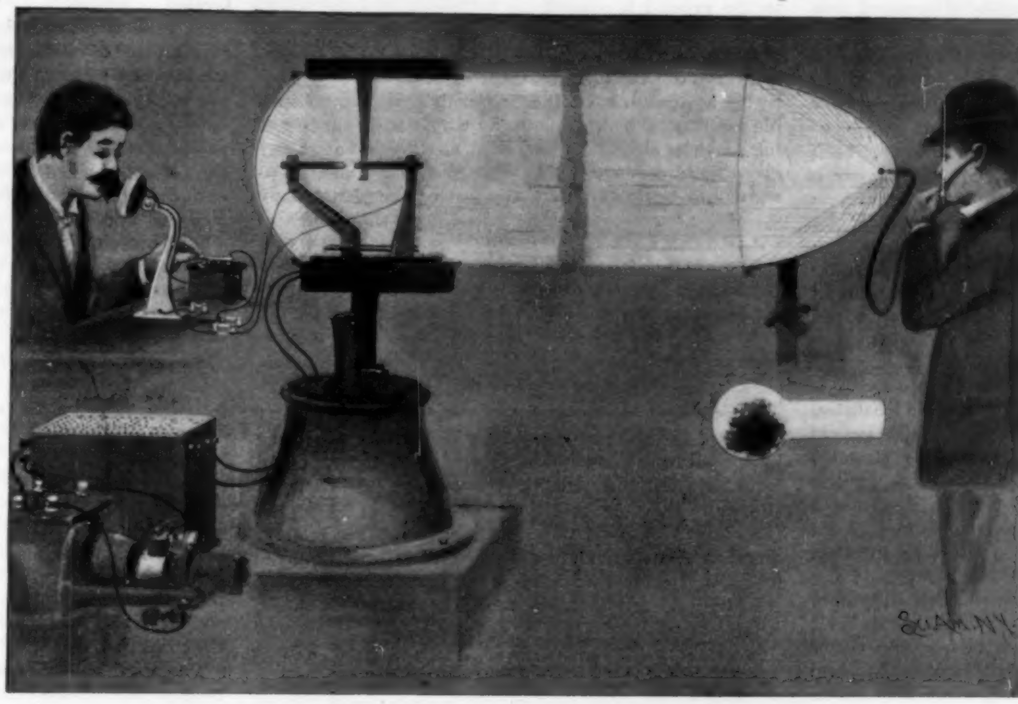
A NEW and expeditious method for driving piles is described in the instructions as to technical works for the Russian Engineer Corps. On two sides of the pile to be driven are made longitudinal grooves of sufficient width and depth to receive ordinary iron gas pipes of 1 inch or 1½ inches diameter, terminating in nozzles like those of hose pipes, and turned toward the point of the pile, being fixed to it by light staples, while the upper ends are connected by gutta percha pipes with a force pump capable of injecting water under a pressure of five atmospheres—71 pounds per square inch. It is said that the outflow of this water at the point of the pile causes the latter to sink three or four times more quickly than it would under the action of a pile driver. A few blows are, however, given by the monkey when the pile has attained the desired depth, in order to secure the necessary consolidation, and the gas pipes are then drawn out in order to serve for driving another pile.



A SNAKE-INFESTED REGION IN OREGON.

THE RADIOPHONE AT THE ELECTRICAL EXHIBITION.

Interest in the electrical show at the Madison Square Garden, in this city, continues unabated. On May 13 the first exhibition of an improved form of wireless telegraphy took place, which attracted considerable attention on account of its novelty and simplicity. It is an apparatus for transmitting varied heat waves in a beam of light to a receiver capable of reproducing the highest sound vibrations with accuracy.



THE RADIOPHONE—A NEW FORM OF WIRELESS TELEGRAPHY.

Referring to the illustration representing the way the apparatus is arranged, there will be noticed on the left the generator, next to it a rheostat for adjusting the supply of current to the arc light located inside of a parabolic reflector fixed to project a parallel beam of light in the usual way. A shunt wire runs from each terminal arm of the carbon holder to a knife switch, and from that one wire goes to the base of the usual telephone transmitter arm, while the other is connected to a small resistance box with a regulating switch to adjust the strength of the current to the transmitter. From this resistance box the wire is connected to the other side of the transmitter. Instruments located in this shunt circuit indicated a current of four or five amperes with a voltage between forty and fifty.

When the transmitter is vibrated by the sound of the voice, or of a musical instrument, the current flowing through the shunt circuit varies to correspond, and this varies the main current, passing directly between the carbons. In the focus of the receiving parabolic reflector is placed a glass bulb holding a small quantity of carbonized filament (this will be seen enlarged at right of the picture). From this bulb a tube runs through the back of the reflector and is connected by a rubber tubing to small ear phonograph tubes.

At the time we heard it a cornet was playing in front of the transmitter; the notes came out clear and distinct in the parabolic receiver about 350 feet distant, and about one-third as strong in volume as the sound heard in the ordinary electric telephone receiver. The fluctuation of the temperature of the fiber in the bulb due to the variable impinging heat waves causes like fluctuations of the volume of air in the bulb which acts upon the drum of the ear. The light is only projected for brief intervals at a time, as a continuous heating of the carbonized fiber reduces the sound. The instruments are placed in the regulation telephone booths, one side of the booth being partly open to allow the electric light beam to freely pass. It is said that signals and speech have been transmitted a distance of two miles, from a vessel to the shore, by means of larger and more powerful searchlights.

New Port for Montevideo.

The Hon. W. R. Finch, United States Minister to Paraguay and Uruguay, informs us that a contract for building a new port at Montevideo for Uruguay is to be given out. The amount of money required to complete the job will not be far from $10,000,000, and he believes the government of Uruguay will give American capitalists and contractors more than an equal chance of obtaining the contract for building a port. Contractors may communicate with him at Montevideo, and the information as to what is required is also on file at the State Department at Washington.

ANIMAL COMMUNITIES.

BY C. F. HOLDER.

The schooling, swarming, herding or flocking of animals presents a fascinating subject, and the causes which govern the various movements constitute an elaborate study. Recently the writer while duck shooting in a California tule swamp became so interested in the flocking of birds that he forgot the ducks. Before the blind extended hundreds of acres of tule swamp which resounded with the notes of the blackbirds. As the sun rose, there was a concerted movement among the birds, and as near as could be judged from five hundred to one thousand birds would rise, as though a signal had been sounded, and sweep on, filling the air with their sounds, then as suddenly drop into the tules on the edge of the swamp. This appeared to be the rendezvous, as though some general officer was appointing the birds to certain farms and ranches for the day, as from this spot other divisions, each composed of hundreds, rose as one bird, flying off in different directions—a proceeding which was kept up for several hours until every ranch within five miles must have received its flock of red-winged blackbirds.

Many of the birds appear to form in flocks at the time of migration. The Pacific brown pelican is prone to fly in flocks of from ten to fifty, while its cousin of the Gulf of Mexico is to some extent a solitary bird.

Among the fishes the swarming or schooling is particularly noticeable. The herrings, sardines and their allies are always banded together, in all probability for mutual support, and the study of a school is an interesting pastime. The fishes seem governed by some one impulse, and the greatest order is preserved; the school hurrying up, down, or to the side as a single fish. Yet this schooling is often their undoing. The writer has seen a small seal so intimidate a

large school that they were concentrated into a ball of living fish not ten feet across. The seal swam around them with great velocity, preventing their escape, occasionally dashing into them with wide-open mouth.

The California barracuda is always found in schools, filling the water for acres. The Gulf of Mexico species is a solitary fish. In the Pacific the yellow-tail schools often cover the water for acres, then breaking up into pairs or trios. So with the horse mackerel; thousands frequently being found schooling.

Among the mammals the collection of vast numbers is best illustrated by the American bison, which was, and which now, owing to the most outrageous vandalism ever perpetrated in a civilized land, is almost extinct. The bison fairly covered miles of country, presenting a marvelous sight.

The most extraordinary collection of animals to be seen in America are the fur seals which gather at the Pribylov Islands in spring, at the breeding season, later going to sea, and south in February and March, as far as the Santa Barbara Islands, several having been observed at Santa Catalina during the present year, a sea migration of many hundred miles being taken each year.

A very similar movement is seen among the penguins of the South Pacific islands. At times what is supposed to be millions of birds are found on the islands; later they disappear completely, making an ocean trip to some unknown land or sea for unknown purposes and reasons.

This herding or collecting of large numbers is not so common among reptiles, though in certain localities, as illustrated by the accompanying photograph, snakes congregate in large numbers. In Montana a singular cleft in the rocks has been famous for years for the snakes of all kinds which seem to have chosen it as a home. It is of unknown depth, and so snake-infested that no one has had the temerity to probe its interior. Yet every fall quantities of snakes from long distances away have been seen proceeding in this direction, finally entering the hole in the ground, recognizing the place and location as a favorite one for winter hibernation. At the time of these gatherings the place presents a sight that might have been the inspiration of Dante in some of his weird conceptions, the rocks being literally covered with snakes.

More remarkable still for its myriads of snakes is the region about Klamath Falls, Oregon. The writer is indebted to Mr. Castle, the postmaster of the town, for the photograph, which he states does not do justice to the actual condition of affairs, showing, as it does, but a small section of the snake-infested region. The town stands upon the bank or near a little river which for some reason has an attraction for these snakes or is peculiarly adapted to their requirements. Possibly birds which prey upon the snakes are for some reason scarce at this point, and the reptiles have had no interruption for years. Be this as it may, whatever may be the cause, the land along the river front is without exaggeration fairly alive with snakes that are heaped one upon the other, in groups, singly, in rows, lines and masses. One might well believe that the forms shown in the accompanying illustration were cunningly arranged to convey the idea of numbers; but they were photographed as they were found, and Mr. Castle informed the writer that by selecting a place later in the season many more could be shown.

The snakes hibernate here through the winter in holes and crevices adjoining the river bank, and in obedience to the warm sun of spring crawl out and bask in its rays; covering the ground with their sluggish forms and presenting a scene so remarkable in its entirety that it might well be considered the result of a distorted imagination. The snakes, fortunately, are perfectly harmless, and make little or no demonstration when approached, paying no attention to the photographer.

An Invention Wanted to Utilize Fog.

Mr. Herbert Earlscliffe, of Santa Barbara, Cal., has communicated to the Weather Bureau, through the Chamber of Commerce of Los Angeles, a suggestion relative to fog that should call forth all the inventive genius of America. Mr. Earlscliffe says:

"In California there are vast areas of valuable land where the water supply is insufficient. Nature has endeavored to correct this by sending in heavy fogs laden with moisture, and it only remains for the ingenuity of man to utilize this. These fogs generally come in from the ocean at night during the dry summer months, when most needed, but are dissipated early in the morning by the sun. Here is ample moisture brought to our very doors if we could but discover some simple and practical method of condensing or precipitating it on a large scale."

It certainly is tantalizing to think of this immense quantity of moisture present and visible but unavailable. Neither science nor art, at present, can suggest any feasible method of causing this fog to descend in refreshing drops of rain. On the other hand, the green vegetation at the summits of many mountains has often been observed to be due essentially to cloud or fog and not to rain; it may, therefore, be hoped that along the coast of California some device will soon be introduced that shall catch the fog particles as they float along and force them to trickle down in gentle streams of water so as to moisten the earth. We do not propose to condense or precipitate the atmospheric moisture in the ordinary sense of those words, but simply to catch it as the leaves of the trees do. We recall the so-called drip from every rock and twig on the summit of Table Mountain at Cape Town, and especially on the summit of Green Mountain in the island of Ascension, and the dampness of the rocks on Pike's Peak, and we cannot doubt but that in many spots throughout the globe vegetation is kept alive by the small amount of moisture that is caught on the leaves, and dripping thence to the ground is soaked up by the roots of the plant. In fact, there are several plants whose leaves and branches are so arranged as to facilitate drip and the collection of moisture by this process. What is needed by the agriculturist on the California coast is some simple mechanical arrangement by which the quantity of fog particles shall be intercepted as they flow past any given plant, and shall be forced to drip or glide downward into the ground at the root of the plant. Any fan-shaped arrangement of sticks or slats that increases the area exposed to the fog should apparently increase the quantity of moisture carried down to the roots. Mechanical devices, the explosion of dynamite, refrigerating apparatus, and other analogous devices are likely to be too expensive in comparison with the return they make.—Monthly Weather Review.

Some German Acetylene Statistics.

Two of the German acetylene journals have become interested in the statistical side of that industry, and have collected and published considerable data upon the subject. One of these journals, Das Acetylen (February 25), sent out 52 blanks and received 37 answers, from which, with collateral information, the following figures were derived.

In 1898, in the German acetylene apparatus shops, there was sold:

Generators	6,451
Burner capacity of each generator	1 to 300
Total burner capacity	112,355
Candle power of burners in Hefner candles	10 to 60
Candle power of burners in Hefner candles, total	3,182,100
Average burner capacity of generator	17
Average candle power of burner in Hefner candles	28

The demand was greatest for apparatus having a capacity of 15 to 30 burners.

Upon the basis that the generation of one Hefner candle (0·888 English candle) requires 0·0265 cubic feet of acetylene, the above capacity of 3,182,100 candles would require the consumption of 84,325 cubic feet of acetylene. If one pound of carbide generates 4·8 cubic feet of gas, there was therefore required a supply of 17,567 pounds of carbide per hour, or, on a basis of a yield of 4·46 cubic feet per pound, an hourly consumption of 19,000 pounds of carbide. Counting 1,900 burning hours per year, the yearly demand for carbide was respectively 16,688 and 18,050 short tons. Taking the price of carbide at 4 cents per pound, or $80 per ton, we see that the sales must have aggregated, for 16,688 tons consumption, about $1,335,040; this sum doubles itself when we consider that but about half the German and Swiss production of carbide is used in these countries, and therefore that at least $2,770,000 worth of carbide was turned out during 1898.

Generators having a capacity of 25 burners are most in demand, and most of this size are sold. The average price being $125, and 6,451 of these being sold, would bring the total up to $806,375. Calculating that one burner costs 25 cents, the 112,355 burners going with these generators will cost $28,089. The carbide works and acetylene apparatus manufacturers in Germany therefore did a business in 1898 amounting to $3,604,464.

The nine largest acetylene firms in Germany have a capital of $1,122,500; and the smaller firms, having a capital under $25,000 each, will agregate $153,750, making a grand total of $1,276,250. There are 1,020 men employed in the shops.

The practice seems to be to make the distribution pipes not so strong as ordinary city gas pipes above 1·5 inches diameter, and to have them with but one-third the cross-sectional area for the same service. The valves and fixtures are made of brass, red castings (75 to 80 per cent copper), white metal and iron; practice has shown that the fear formerly existing as to the formation of explosive acetylides of copper has no foundation.

For generator construction, with few exceptions, leaded iron is used, the plates being from 0·63 to 0·016 inch in thickness (Nos. 10 to 12); in one case, a pressure generator, the walls were from 0·23 to 0·58 inch thick. One firm reported the following weight of plate used: 15 flame generators, 0·039 inch; 30 flame, 0·058 inch; 100 flame, 0·078 inch; 150 flame, 0·117 inch; above this, 0·156 to 0·175 inch. Another firm does not go below 0·058 inch plates even for three to six flame generators. All firms offer the forked burner, some entirely of steatite, and others with steatite heads only, and either angular or of horseshoe shape. In answer to the query as to how many feet of pipe had been laid, seven firms answered that they had put in 533,000 feet of from ¼ to 3 inch pipe.

THE EFFICIENCY OF THE BICYCLE.*

The object of this paper is to call attention to a few interesting points in connection with the efficiency of the bicycle.

In the present investigation no attempt has been made to treat the bicycle under road conditions, but simply as a machine; and the efficiency tests therefore have been conducted along the same lines and with practically the same apparatus as that used by Mr. Mack, and described in his paper before the American Society of Mechanical Engineers.

The apparatus, as shown by the photograph, consists of a 10-inch I beam, 15 feet long, planed smooth on top, mounted at a convenient height and carefully leveled.

At one end of the beam is fixed a pulley, over which runs a piece of indicator cord carrying a scale pan and attached by wires to the rear axle of the wheel. Suspended from the seat post is a frame made of ordinary inch pipe and carrying a shelf 3 feet long. This shelf is placed a sufficient distance below the beam to insure the perfect balance of the wheel when a load of 150 pounds (representing the weight of the average rider) is placed upon it.

The bicycle is now used as a hoisting machine, known weights placed in the scale pan at the rear of the machine being raised by placing other weights in the pan attached to the pedal. These latter weights, which drive the wheel forward through a short distance, are taken from the shelf, thus keeping the total load on the wheel constant. As weights are transferred to the pedal pan the balance of the wheel is maintained by adjusting the remaining weights on the shelf.

As the effective radius of the crank varies very slightly for a distance of some ten degrees on each side of the horizontal, it may be assumed as practically constant during this portion of a rotation.

The apparatus thus represents a rider, weighing 150 pounds, sitting upright and gradually throwing his weight from the seat to the pedal, in order to propel the machine.

The total efficiency of the wheel is now determined by ascertaining the energy expended in one revolution of the pedal and the corresponding work done in lifting the weight drawn over the pulley at the rear. The difference between the two must be due to the friction of the intervening parts of the machine.

If B equals the circumference described by the center of the pedal pin and P equals weight on the pedal, then $B\,P$ equals the energy in inch-pounds expended in one rotation of the pedal pin.

If R equals ratio of large to small sprocket and A equals circumference of tire, then $R\,A$ equals distance passed through by the machine for one revolution of the pedal pin.

Letting M equal the resistance overcome, which would equal the weight placed on the pan at the rear of the machine, divided by the efficiency of the pulley, then $M\,R\,A$ would equal the actual work accomplished.

The efficiency would be determined by the fraction

$$\frac{M\,R\,A}{B\,P}$$

Fig. 1 shows the results obtained from two wheels of the same make and grade, these particular curves being chosen as they give practically the same maximum efficiencies.

The full line is the efficiency curve of the chainless wheel, and the broken line of the corresponding chain wheel.

Fig. 2 shows some very interesting facts. The upper or full line curve shows the results obtained from a special racing wheel gotten out for the use of a man riding for the company. It was understood that the bearings were specially ground, and everything done to make the wheel represent the best possible conditions. It was very light in construction, and carried 1⅜-inch tires. The wheel had been ridden only a few hundred miles, and before being tested was specially cleaned and oiled.

In a test of a $50 and a $75 wheel, both from the same factory, and in the best possible condition, the $75 wheel showed a higher efficiency by about 7 to 10 per cent.

A wheel of high grade taken direct from the factory in which the sprocket wheels and chain were apparently rough in finish, gave a very irregular efficiency, which was far from satisfactory. After having the wheel ridden a few hundred miles it was again placed upon the testing machine, and showed from 5 to 10 per cent higher efficiency.

Another test was made on a wheel representing the best practice in bicycle construction and method of protecting bearings, after it had been exposed for some time to the rain. The wheel was frequently left lying out in the rain for hours, and received no care. The curve showed a remarkable efficiency, and, while the average was far lower than that of the corresponding wheel in good condition, yet it would indicate that the

* By Robert H. Fernald, M.E., Member Civil Engineers' Club of Cleveland. Read before the club, February 14, 1899.

bearings had been but little affected by such usage. The chain, while slightly rusted, was entirely free from mud and dirt, which undoubtedly accounts in part for the remarkable showing.

Besides the tests on general efficiency, a few special tests have been made. Among the results of greatest interest are those obtained from the sprocket tests.

All the combinations obtainable with eight, nine, and ten-tooth rear sprockets and from twenty to twenty-five teeth, inclusive, on the front sprocket were tested.

Fig. 3 shows the results obtained from a combination of a twenty-tooth front with the eight, nine and ten rear. The dotted curve represents the efficiency resulting with an eight-tooth rear. The broken line represents that obtained with the nine-tooth rear, and the full line the corresponding efficiency for the ten-tooth rear.

The average of the preceding combinations shows that while a slight irregularity seems to exist for the smaller loads, the effect for the higher pressures is very apparent, and shows for the average maximum values that the nine-tooth rear has an efficiency equal to 98·7 per cent of that of the ten-tooth, and the eight-tooth an efficiency of 98·6 per cent of that of the nine-tooth. The eight-tooth would then show an efficiency of 97·5 per cent of that of the ten-tooth.

It has been often asserted that the tire is the most important factor affecting the efficiency of a wheel, and that the amount of inflation would hide all other possible chances for variation in efficiency. While no attempt has been made in these tests to go into this question in detail, yet just at the close of the other experiments a few interesting results were obtained along this line (see Fig. 4).

It is the present intention to make tests with wheels running at different speeds, and also when the wheels are forced to run over different obstructions made to represent road conditions as nearly as possible, the power required to drive the wheel being determined by a dynamometer.

It is also probable that a pedal dynamometer will be constructed to register the actual force exerted on the pedal by the rider when the wheel is in regular road service. There are many other points of interest, among which are the duration of cone and ball bearings, the effect of vibration of the frame and the efficiency of different makes and grades of tires under increase of speed.

These different points will be investigated as time permits, and a series of results obtained which will be far more complete than those presented in this paper.

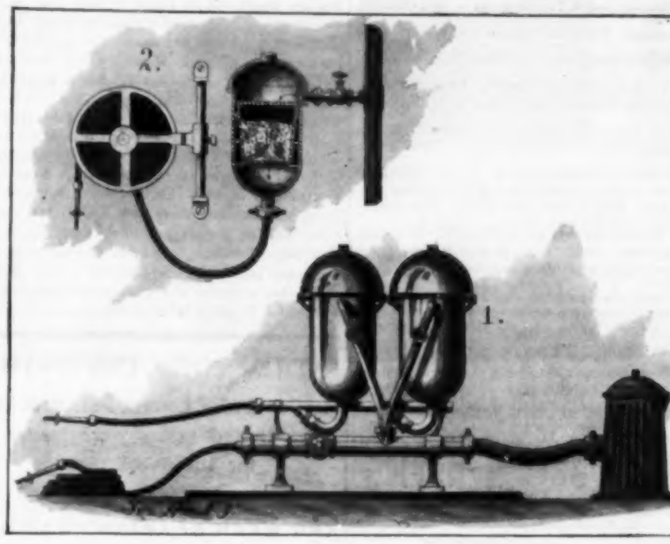
Taxation of Copyrights.

An attempt of the Comptroller of the State of New York to tax copyrights has been defeated. A tax for the year 1897 was imposed by the State Comptroller upon the A. J. Johnson Company, publishers of "Johnson's Universal Cyclopedia," and in proceedings to determine the validity of the assessment, the main objection to it was that the company's property was nearly all invested in copyrights, and that these were not taxable. The Court of Appeals, in opinions by Judges Vann and Gray, has unanimously reversed the decision of the Third Appellate Division, which affirmed the determination of the Comptroller. The court holds that copyrights are not taxable as property, but stand upon the same basis as patent rights, and are exempt from taxation.

The very important previous decision of the court in the case of the Edison Illuminating Company, in which the taxation of patent rights was interdicted, was referred to in the SCIENTIFIC AMERICAN of October 29, 1898.

AN IMPROVEMENT IN CHEMICAL FIRE-EXTINGUISHERS.

In the accompanying engraving, an apparatus for extinguishing fires is illustrated, which is connected with a water supply and is provided with receptacles containing chemicals which, when dissolved in water, produce a fire-extinguishing solution.



A NEW CHEMICAL FIRE-EXTINGUISHER.

Fig. 1 is an elevation of one form of fire-extinguisher. Fig. 2 is a view showing another form.

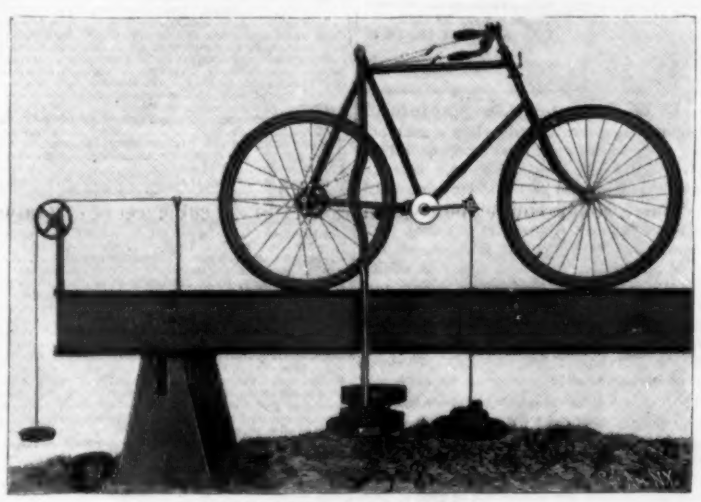
The fire-extinguisher illustrated in Fig. 2 consists of a cylinder provided with a cover and connected, by means of a valved pipe, with a water-supply pipe extending upwardly through the building. At its bottom the cylinder is connected with a hose. The cylinder is designed to hold a perforated cartridge containing suitable chemicals, such as ammonium chloride and sodium chloride, mixed in proper proportions.

In the extinguisher shown in Fig. 1, two cylinders are employed, connected by valved branch-pipes with a water-supply pipe leading to a hydrant. The covers of these cylinders are connected by bails so that they may be quickly removed in recharging the cylinders. At their bottoms the cylinders are connected with a discharge pipe to which a hose is attached.

In the operation of the form shown in Fig. 2, the valve in the pipe connecting the cylinder with the water-supply is opened to permit the water to saturate the chemicals contained in the cartridge. The water containing the dissolved chemicals is then discharged through the hose.

In the fire-extinguisher illustrated in Fig. 1, the chemicals contained in one cylinder are first used; and when these are exhausted, the contents of the second cylinder are used. It is for this purpose that the arrangement of valved pipes already referred to has been devised. If it be so desired, the water can be used directly from the hydrant by closing the valves in the pipes leading to the cylinders and opening the valve in the supply-pipe.

This fire extinguisher has been patented by Abram H. Van Riper and Patrick F. Guthrie, Nutley, N. J.



THE TESTING APPARATUS.

NOT every one is aware that the opening years of the next century will witness the completion of the first milliard of minutes since the beginning of our chronology. From approximate calculations it would seem that the one billionth minute will be reached at 10:40 A. M. on April 30, 1902.

An Educational Index.

For some time past educators have felt the need of a catalogue of popular scientific papers. Mr. J. C. Packard, M.A., has prepared such a catalogue, with special reference to the instructor, librarian and pupil. This catalogue, which is now ready for distribution, is published under the auspices of the Science Committee of the Brookline, Mass., Educational Society, of which Mr. Packard is the chairman.

The booklet comprises forty pages and is small enough to go in the vest pocket. The subjects, which have been selected from the SCIENTIFIC AMERICAN SUPPLEMENT, are classified under such heads as "Archæology, the Science of Antiquity," "Facts About Familiar Elements and Substances," "How to Make Things," "How Things are Made," "Transportation," etc.

The Current Supplement.

The current SUPPLEMENT, No. 1221, is of extraordinary interest; the first page article is "The New German First-class Battleship 'Kaiser Friedrich III.'" It is accompanied by a spirited picture of the vessel at sea. "The Palatine Hill of Rome" is illustrated by many excellent engravings showing the present condition of the ruins and by a clear plan. The text deals with all of the principal remains. Wilson's "Prehistoric Art" is the conclusion of a review of an important book, and is accompanied by nine most interesting engravings. "Wave Action in Guns" is an article by F. H. McGahie, M.E., and is referred to editorially elsewhere. Other articles are "British Coal Supplies," "Electric Hacks at Paris," "The Love Gifts of Birds," "Cultivation of the Vanilla Bean in Mexico," etc.

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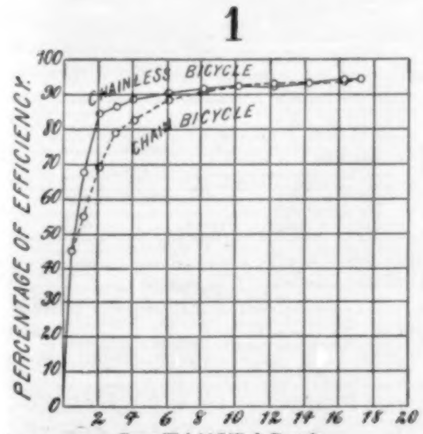
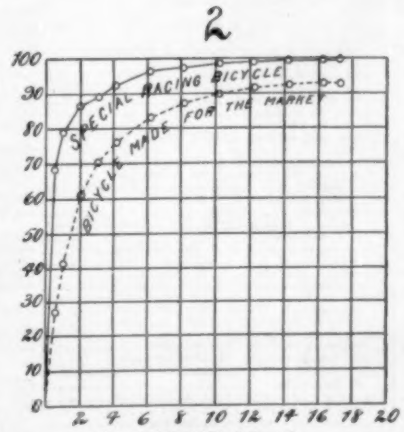


Gross Weight Lifted, Pounds.

Chain and Chainless Bicycles.

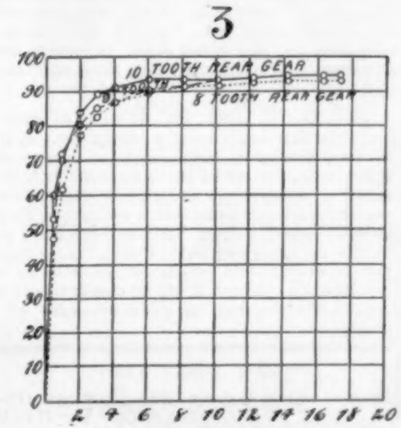
2



Gross Weight Lifted, Pounds.

Special and Common Bicycles.

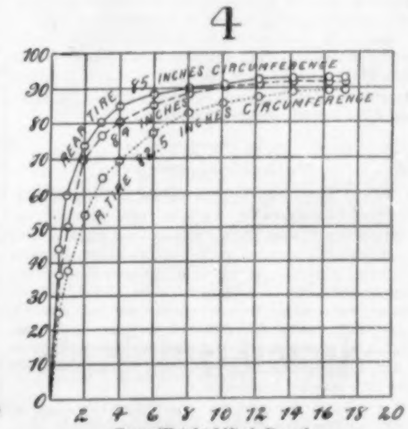
3



Gross Weight Lifted, Pounds.

20-tooth Front Gear, with 8, 9, and 10-tooth Rear Gear.

4



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THE EFFICIENCY OF THE BICYCLE.

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(Illustrated articles are marked with an asterisk.)

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

DEVICE FOR GATHERING FRUIT.—JOHN H. CRUMB, Osage City, Kan. By means of this device the labor of carrying heavy baskets or bags around over the fruit-trees is saved; and the work is thus lightened and expedited. The device comprises a sheet of flexible material having a central opening and provided below the opening with a number of loops of flexible material, crossing one another. The fruit is cast upon the sheet and passes through the opening to the first loop, and thence to the next loop below, and so on until the ground or a receptacle is reached. The fruit can in this manner be gathered without being bruised.

PLOW.—WILLIAM B. GRAY, Ashland, Ore. This plow is especially adapted for hillside-work, and is so constructed that either one of two plows may be raised or lowered independently, and the line of draft directed to accord with the draft-line of the plow brought into operation. The plow comprises a frame mounted upon wheels independently adjustable. Two plows are pivotally mounted in the frame and can be swung into and out of operative position. At the rear of the frame a trail-wheel is mounted on a swinging support, whereby the wheel can be brought into alinement with either plow.

SELF-FEEDER FOR THRESHING-MACHINES.—HENRY KISTER, Morrison Mo. The bundles are thrown on a vibrating bed on each side of a straightening-blade, and are fed forward by the joint action of the vibrating bed with teeth and stationary toothed arms, being straightened as they move forward by the broad longitudinal blade. When the bundles reach a certain portion of the feeder, they pass into a vibrating hopper provided with forwardly-inclined teeth, which feed the bundles down to the threshing-cylinder, the bundles being cut as they descend through the hopper by the shearing action of the cutting blade above. The bundles are thus rapidly and evenly fed to the threshing-cylinder without choking the working parts.

Electrical Apparatus.

TELEPHONE-TRANSMITTER.—JAMES H. SPENCER, Manhattan, New York city. The transmitter has a diaphragm composed of two thin disks, with layers of tissue between the disks, the layers being secured together only at the center. The double diaphragm rigidly held in place is vibrated only by the sound-waves, and can vibrate only in sympathy with this influence. The transmitter, as a result, varies the electrical current in harmony with the sound-waves on account of the accuracy of its vibrations. The sound is, therefore, entirely transmitted and reproduced in the natural tone.

Engineering-Improvements.

STEAM-ENGINE.—ALEJANDRO STEPHENS, Guadalajara, Mexico. In this engine a high-pressure piston is provided, which is surrounded by an annular low-pressure piston, the two pistons being rigidly secured together. The high-pressure piston has a passage leading from one face to the other face, and controlled by a cut-off valve. The pistons move in a cylinder having two chambers. A receiver has a valve-controlled connection with the working chamber of the high-pressure cylinder; and the low-pressure cylinder has a channel leading to the receiver and to the exhaust. A valve opens this channel to the receiver when the high-pressure piston is at the end of its working stroke and connects the channel with the exhaust when the high-pressure piston is at the end of its inactive stroke.

PUMP-GOVERNOR.—THOMAS P. FORD, Brooklyn, New York city. The pump-governor comprises a casing in which a diaphragm is held. A tube extends through the diaphragm and communicates with the liquid to be pumped and with the valve controlling the steam-supply pipe of the pump, which valve carries a weighted lever. When the liquid to be pumped rises, it passes into the tube and ascends until the weight of the column of liquid is sufficient for the weighted lever to overbalance the weight of the stationary column on top of the diaphragm, so that the tube moves up and the valve is opened to permit steam to pass to the pump. When the level of the liquid falls, the reverse operation takes place.

Mechanical Devices.

PUMP-ROD-OPERATING DEVICE FOR WINDMILLS.—WILLIAM E. VERNON, San Angelo, Tex. The windmill has an oblong plunger-head provided with internal teeth forming a rack. The windmill operates a gearing, a portion of which is arranged for alternate engagement with the teeth at the sides of the plunger-head, being adapted to elevate the head and permit a more rapid descent than ascent of the head. A plunger-shaft is connected with the plunger-head and is connected with a retarding device, which regulates the speed of the downward movement.

WEDGE-CUTTING MACHINE.—GEORGE M. CLUBB, Mullan, Idaho. This machine comprises a saw, a saw-table, and an endless belt traveling over the saw-table with one side close to and parallel with the saw. The belt has combined feeding and spacing blocks adapted to engage and present rectangular blocks to the saw, so that they will be diagonally ripped. By means of this machine a large number of wedges may be made in a short time; and all the wedges will be of exactly the same size and bevel. The machine will thus reduce the cost of wedges when large numbers are to be used.

Designs.

OAR-LOCK.—MARCUS P. NICHOLS, St. Paul, Minn. The oar-lock-shank is provided with two spring-members formed with shoulders at their lower extremities. The shoulders firmly hold the shank in the gunwale-socket; but the oar-lock may be readily removed by pressing the two spring-members together so as to unseat the shoulders.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(7664) F. W. D. writes: Can you inform me through the SCIENTIFIC AMERICAN how to get rid of small black or brown ants which have nearly spoiled the grass on my lawn? They make their runs near the stem of a blade of grass, and the whole lawn is covered with them. This is the second year of their appearance, and a handsome grassplot promises to be ruined. Answer by Prof. C. L. Marlatt, Acting Entomologist, Department of Agriculture. The best means of ridding lawns of ants is in the use of bisulphide of carbon, perhaps the most valuable insecticide for subterranean insects. A number of holes should be made in or about the ant nest with a stick or iron rod, and an ounce or two of the bisulphide poured into each hole. The holes should be closed immediately by pressing the earth over them. The chemical evaporates and penetrates throughout the soil, quickly destroying the ants. Three or four ounces should be sufficient for a large nest. Very small nests or beginnings of colonies can be exterminated by making one or two holes only. If used in large quantities it is apt to kill grass, and should not be used in large amount within one foot of the roots of any valued plant. It must also be borne in mind that bisulphide of carbon is an extremely volatile liquid and very inflammable, and in its storage it should be kept carefully bottled up and away from fire, even lighted cigars. In using it, the precautions in the matter of fire must be constantly observed.

(7665) G. T. asks for details of construction of an induction coil of a specified size. A. If this coil is intended to produce an induced current of high E. M. F., you are on the wrong track. It is too large to be wound in two sections, etc. The simplest way for you to obtain correct data is to send us ten cents for SUPPLEMENT, No. 1124, which describes a coil of the same size as you wish, giving a spark 6 inches long. You can easily make the primary coil removable, but it contains so few turns that it will be cheaper to make a second coil for your other use than to make this one removable.

NEW BOOKS ETC.

MECHANICAL MOVEMENTS, POWERS, DEVICES AND APPLIANCES. By Gardner D. Hiscox, M.E. New York: Munn & Company, office of the SCIENTIFIC AMERICAN. 1899. Sixteen hundred and forty-nine engravings. 8vo. Pp. 402. Price $3.

This volume is the work of a well-known engineer who has had an extended experience in mechanical matters. He has gathered together and classified sixteen hundred and forty-nine illustrations of early and modern mechanism, and has appended a concise description to each. The engravings are all new, having been made especially for this work. The first chapter of the book is devoted to Mechanical Powers, Levers, Gears, Pulleys, etc.; then follows a chapter on the Transmission of Power by Pulleys, Belts and Ropes; also Sprocket Wheels and Chains; Gearing and Friction Wheels, including Belt Lacings of various kinds. Liberal space is devoted to the Measurement of Power and Speed; Steam Power, including boilers and various types of engines, receives due attention. A large number of rotary engines is presented in this chapter. Under the head of Steam Appliances are found many different Injectors, Condensers, Boiler Feeders, Boiler Cleaners, Reducing Valves, Expansion Joints, etc. Gas and Gasoline Engines and the parts thereof take the greater portion of a chapter. Hydraulics occupies a considerable space and includes a large number of modern devices. Air Power Appliances, including Windmills, Bellows, Blowers, Air Compressors, and various devices used in connection with air as a motive power, receive the attention they deserve at this time, when the use of compressed air as a motive power is coming to the front. Electric Generators, Motors, Wiring, Controlling and Measuring Apparatus, as well as Electric Lighting, Furnaces, Fans, etc., fill a considerable space. In a chapter on Navigation and Roads various forms of sails and rigging are described, also numerous propellers; Road Rollers and Automobile vehicles are shown and described. Under the head of Gearing and Mechanical Movements is given a great variety of mechanical devices both new and old. The chapter on Horology describes the principal movements used in clocks and watches. Mining apparatus is illustrated with a series of engravings, and the pages describing Mill and Factory Appliances contain many new devices. The various apparatus used in Drawing occupy a number of pages, and the book closes with a chapter on Miscellaneous Devices, which, as the name indicates, includes mechanism which could not be readily classified. The book is printed in large clear type on fine heavy paper, and handsomely bound. Engineers, mechanics, inventors and amateurs will find this volume a magazine of useful information.

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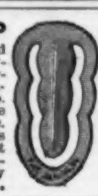

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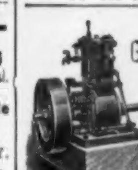

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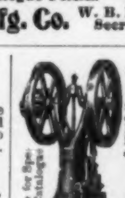

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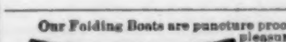

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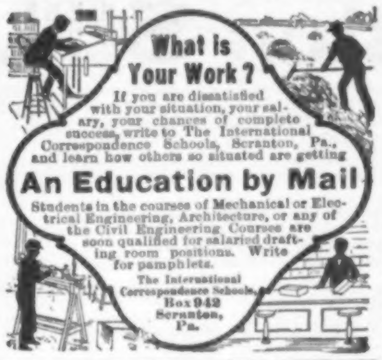

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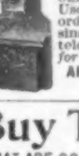
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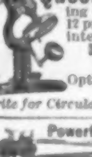
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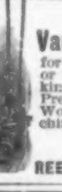
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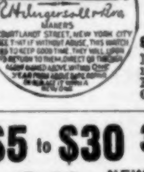

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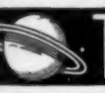
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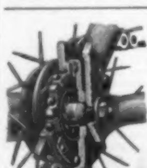
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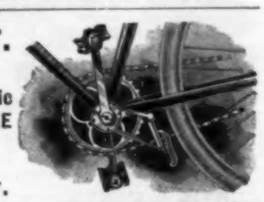
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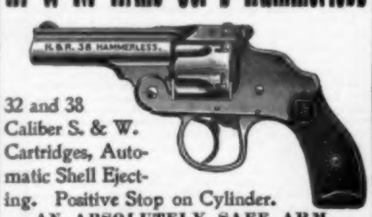

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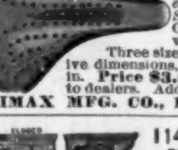
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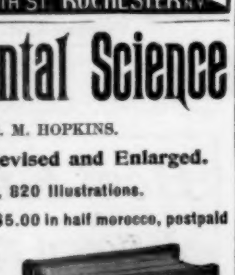

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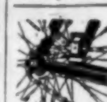

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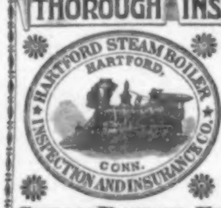

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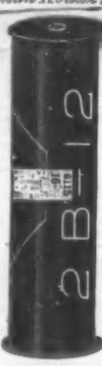

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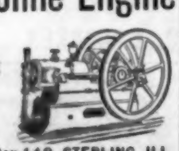

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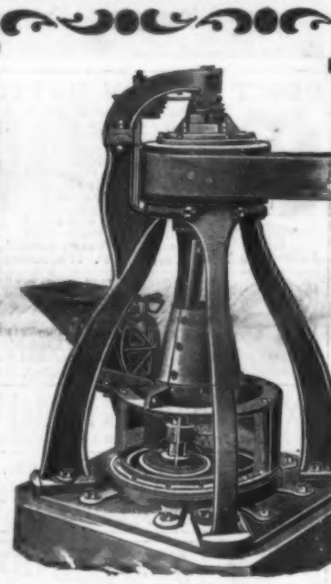

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